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UNCERTAINTY VERSUS LEARNING: A NETWORK APPRAOCH FOR CORPORATE STRATEGIC PARTNER SELECTION

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ABSTRACT

Uncertainty and learning play important twin roles in interorganizational partner selection decisions. Research reveals that companies try to reduce uncertainty by engaging in repeated ties with partners who are familiar, who are tied to common third partners, who are similar along relevant strategic or organizational dimensions, or with partners controlling complementary resources. Because organizations learn from their own experience and from the experience of their partners, one way to understand global network structures is to analyze how uncertainty and learning jointly affect the propensity of individual organizations to build local network ties. This paper combines theory and empirical evidence to develop an analytical framework examining the dynamic relationship between uncertainty, organizational learning, and the formation of interorganizational network ties. I report clear evidence that organizational uncertainty increases the likelihood that companies will engage in corporate acquisition activities. I also find that organizational learning and past experience play important roles in acquisition partners' selection, i.e., the greater the cumulative number of acquisition events in which a company has been involved in previously, the higher the likelihood that it will engage in further acquisition events in the future. Finally, I demonstrate that an organization's past experience in corporate acquisitions affects its choice of network partner.

Contribution/ Originality: This study documents how organizations take advantage of available opportunities to extract insights from their own past experiences and from the experience of their partners. The paper's primary contribution is to analyze how uncertainty and learning jointly affect the propensity of individual organizations to build acquisition network ties.

1. INTRODUCTION

Uncertainty and learning play important twin roles in interorganizational partner selection decisions. Research reveals that companies try to reduce uncertainty by engaging in repeated ties with partners who are familiar, who are tied to common third partners, who are similar along relevant strategic or organizational dimensions, or with partners controlling complementary resources. As organizations get opportunities to extract insights from their own past experiences and from the experience of their partners, one way to understand global network structures is to analyze how uncertainty and learning jointly affect the propensity of individual organizations to build local network ties. In this paper, as I am interested in interorganizational network changes by investigating causes that

might influence the choice of acquisition partners, I suggest that organizations' choice depends basically on both past experiences and uncertainty that organizations are facing. To argument my claims I focus firstly on the resource and dependence theory and secondly on organizational learning theory. The former is used to explain and defend the uncertainty argument, i.e., how organizational uncertainty end environmental dependencies affect the choice of acquisition partner. The latter is used to emphasize the experience accumulation argument, i.e., how cumulative previous experiences constitute a mechanism and an opportunity for learning; allowing organizations to engage in further acquisition relations in the future. The model for network dynamics that I test in this paper is based on procedures that were developed mathematically in Snijders *et al.* (2007;2010).

2. THEORETICAL BACKGROUND AND HYPOTHESES

2.1. Organizational Uncertainty

Uncertainty refers to the difficulty faced by organizations in predicting the future, a matter that is due to their lack of resources, information, and knowledge. Management studies of uncertainty have shown that organizations and individuals have struggled to alleviate the uncertainty burden because as Hogg and Terry (2000) stated "[C]ertainty renders existence meaningful and confers confidence in how to behave and what to expect from the physical and social environment". The uncertainty-reduction conjecture highlights the fact that reducing the amount of uncertainty motivates the individual and guides them through their behavior (Bourgeois III, 1984; Hogg and Mullin, 1999). These arguments apply not only to individuals but also to organizations as well. For instance, the notion of uncertainty has been a key issue in dealing with various structural arrangements, particularly organizational design (Thompson, 1967; Williamson, 1981). Consistently, organizations might suffer from uncertainty due to some internal changes, such as merging with or acquiring another firm (Haunschild, 1994) exploring a new market (Greve, 1996) or manifesting an intense change in top management and leaders. Uncertainty is not only the product of internal factors, i.e., it may arise from external factors, such as the relationship between a given organization and its partners (Gulati and Westphal, 1999; Williamson, 1999).

Since the pioneer work of Pfeffer and Salancick (1978) the resource dependence theory has been used and applied extensively in the organizational theory and the strategic management fields to argue how firms minimize environmental uncertainty. In their review on resource dependence theory, Hillman *et al.* (2009) summarized the main options found in the literature that organizations can undertake to reduce uncertainty and environmental dependencies. Among these options, Hillman *et al.* (2009) mentioned mergers and acquisitions, interorganizational relationships such as buyer-supplier relations and minority acquisitions. The resource dependence theory constitutes one of the common theoretical arguments found in the organizations' studies that explain why organizations engage in interorganizational relationships in general, and in mergers and acquisitions in particular. Browsing in the literature, many empirical studies have argued and supported the advantage of using interorganizational relationships to decrease international and domestic uncertainty in a way to provide access to different resources (Stearns *et al.*, 1987; Elg, 2000). Similarly many studies on resource dependence theory showed that interorganizational relations are more likely to develop between international or/and domestic buyers and suppliers (Murray *et al.*, 2005). In in their study on firms' merger from a resource dependence theory point of view, Casciaro and Piskorski (2005) explained the duality between power imbalance and mutual dependence by showing that merger increases mutual dependence and decreases power imbalance. Other scholars integrated resource dependence theory with different theoretical orientations and perspectives in order to investigate more closely the causes of interorganizational relationships. Among these theoretical orientations and perspectives, the resource dependence theory was linked to agency theory to emphasize the control structures of the interorganizational relationships (Kumar and Seth, 1998) network theory to focus on the embeddedness of organizations in their social context and to predict their partner choices (Gulati, 1995; Elg, 2000; Steensma and Lyles, 2000) resource based

view to examine the complementarity between exchange partners (Murray *et al.*, 2005) and game theory to highlight the impact of the partners' power (Saxton, 1997).

Despite its relevance, resource dependence theory and environmental interdependencies have been demonstrated not to be the only predictors and determinants of interorganizational relationships. Many other considerations include for example the industry conjecture (Hitt and Tyler, 1991) institutional norms (Palmer and Barber, 2001) and the historical context of the organization (Finkelstein, 1997). Often, firms that are facing high levels of uncertainty exhibit a need to diversify their network of partners just like investors, who have to broaden their portfolios to minimize the nonsystematic risk. The more diverse the organizations' network, the more exclusive and unique information the firm will gather, which will both promote the level of organizations' decisions (Beckman and Haunschild, 2002) and reduce any external aid from other partners. Beckman *et al.* (2004) reported that "[N]ew partners in an organization' network offer one important source of new information and broaden the scope of the organization, increasing the likelihood of obtaining new information and of adding to the diversity of information to which an organization is exposed".

The relationship between uncertainty and broadening is strengthened thanks to several empirical studies in the interorganizational literature. For example, Powell *et al.* (1996) argued that organizations facing high levels of uncertainty and experiencing a shortage of expertise to develop new knowledge and to keep it new are pushed to form new partnership relations with other organizations. Similarly, Gulati (1995) and Galaskiewicz and Shatin (1981) reported that as a consequence of market uncertainty, organizations form new relationships with partners they know well. Following the same line of arguments, Lomi and Pattison (2006) argued that resources and interorganizational dependence can move from a local dependency to a multiplex dependency through expanding multiple networks. So, viewing an organization' network as a source of knowledge to be investigated, organizations further develop that source by establishing new partnership relations with new partners. These partnership relations can be seen as an exploration response through data collection on new possibilities and new alternatives. As a result, it is clear that uncertainty constitutes one of the fundamental causes for broadening the scopes of organizations through forming new relationships with new partners. Forming new relationships is considered as an action from the organization side and a trust from the partners' side, which may promote investor concern. Stated clearly, organizations try to minimize uncertainty by forming new networks with other partners. Their ultimate aim is to look for diversification in information, thus ensuring the legitimacy of their work. Hence, new networks are more likely to bring new information than existing networks. All these empirical arguments suggest my "*organizational uncertainty*" hypothesis (H1).

Hypothesis 1: The higher an organization's uncertainty the higher the likelihood that it will engage in corporate acquisition activities.

2.2. Interorganizational Routines and Experience Accumulation

Earlier researches on acquisitions have utilized studies on learning patterns that were fundamentally built up to examine industrializing processes (Lapré *et al.*, 2000) and to investigate whether or not processes of learning are present within acquirers. They related the accumulation of acquisition experience to organizational learning and to acquisition performance (Pennings *et al.*, 1994; Haleblian and Finkelstein, 1999). Organizations were shown to simply learn how to handle acquisition processes by repeating to do more the same action which leads to the formation and the improvement of tacit organizational routines (Zollo and Winter, 2002). In fact the reason behind hypothesizing that an organization's experience accumulation will lead to a better understanding of the organizational learning process and to an enhanced organizational performance was discussed broadly in many streams of research. For example, the learning curve studies have discussed how the unit costs of production constitute a deceasing function of the routinized activities of a given organization and its experiences' accumulation (Yelle, 1979; Dutton and Thomas, 1984). Later on, this same body of work has questioned into the various reasons

that might affect the learning curves (Mukherjee *et al*., 1998). Furthermore, a deeper examination of the learning process, by taking into account the whole range of actions executed within the boundaries on a firm, has been investigated by the behavioral school in organizational theory and in strategic management (Mukherjee *et al*., 1998). Consequently, organizations have been demonstrated to gather and accumulate a broad understanding of how to perform organizational tasks that is implicitly renewed and refined to attain permanent development in performance.

Interorganizational routines represent established and stable models of behavior that differentiate and characterize organizational feedback to different types of stimuli. In static environmental conditions and context, one learning phase (e.g., year) can be a source of advantage for a longer phase and might also be sufficient to endow a firm experiencing plenty operating routines. Incremental enhancement may be achieved via the implicit accumulation of experience and creative actions. Nevertheless, in unstable environmental conditions where regulation, technology, and competition are changing perpetually, undertaking the identical operating routines becomes obviously random and hazardous. For these reasons, organized efforts and forces are required to trail the environmental transformations. Zollo and Winter (2002) investigated the mechanisms that help firms develop dynamic capabilities, which they defined as routinized actions undertaken by a given firm in order to adapt and improve its operating routines. They focused on the roles of experience accumulation, knowledge articulation, and knowledge codification, and emphasized that these efforts and dynamic capabilities have to be built up and extended through the learning process. It is also worth to notice that if environmental transformation is too rapid, erratic in direction and unforeseen; dynamic capabilities and learning mechanisms have to be updated continuously. Gavetti and Levinthal (2000) reported that "[r]outines reflect experiential wisdom in that they are the outcome of trial and error learning and the selection and retention of past behaviors". This observation is related to the fundamental task of implicit knowledge especially when learning is experimental, and to the thought that organizational routines are processes that have memory (Cohen and Bacdayan, 1994). Consistently, this observation is in harmony with the traditional belief that organizational learning, which is nothing else than organizational skill development, consists of repeating the execution of identical actions and tasks (Olivera and Argote, 1999). All of these theoretical arguments suggest a positive relationship between an organization's acquisition experience and potential future acquisition activities. In my study I try to capture this "learning by doing" hypothesis and my "*experience accumulation*" hypothesis can be formally stated as follows:

Hypothesis 2a: The greater the cumulative number of acquisition events in which a company has been involved in previously, the higher the likelihood that it will engage in further acquisition events in the future.

Firms often exhibit signals of learning from each other. A broad organizational literature on learning is available that addresses directly this mutual learning mechanism. For example, this has been shown in the innovation's diffusion studies (Greve, 2005) and in the experiences' spillovers researches (Greve and Taylor, 2000). These results have been reported by demonstrating that firms look to control leaks of precious knowledge (Lippman and Rumelt, 1982) experience complexity in absorbing existing knowledge (Lane and Lubatkin, 1998) and do not follow and adopt easily technological transformations (Tushman and Anderson, 1986).

Beckman and Haunschild (2002) stated that "[N]etworks are considered a potential source of learning facilitating learning by promoting efficient skill transfer among firms or by producing novel syntheses of existing information". Several other studies have documented that networks positively affect a wide range of organizational outcomes (Hamel, 1991; Uzzi, 1996) ranging from organizational expansion (Podolny *et al*., 1996) and the duration needed by an organization to launch a product on a new market (Hansen, 1999) to survival (Uzzi, 1996) and the probability of being acquired by others (Palmer *et al*., 1995). Therefore, networks have been shown to have a real impact on firms' decisions of forming partnership relations. In parallel, empirical research has shown that interorganizational partner selection is a function of embeddedness. Particularly, organizations rely strongly on their past partners when forming new alliances (Uzzi, 1997; Gulati and Gargiulo, 1999). An important question

arises here: why do organizations rely on their past relationships to form new corporate relationships (acquisitions)? First, Gulati and Gargiulo (1999) expressed the dominant rationale found in the interorganizational literature by suggesting that this research behavior might be the result of organizations attempting to choose competent and reliable partners. Yet, evaluating the qualities through their explicit relationships is problematic, as data is scarce and expensive. Also organizational learning as a behavioral search has been shown to be the consequence of path-dependent routine as well as a result of scarcity of information outside the searching organizations' neighborhood. It has been argued in the literature that repetitive patterns of learned behavior develop as organizations respond to similar stimuli over time (Amburgey and Miner, 1992). Reliably, behavioral learning models emphasize that in particular situations firms might focus and rely on their own historical experience (March, 1988) with past solutions to previous difficulties becoming the starting point for new strategies, researches, and decisions.

The process of acquisition realization creates a broad range of knowledge diffusion and a better understanding of the executive and managerial experiments particular to the acquisition process. Reliably, one fundamental mass of information accumulated during the acquisition process has to do with the partnering organizations themselves. Since both target and acquiring companies act together over the operational fine points of the acquisition agreement, they become better able to develop a clearer understanding of each other's strengths, weaknesses, and dynamic capabilities. Therefore, acquisition partners implicitly develop series of routines by engaging in repeated and multiple acquisition activities with each other. These routines underlie the approach with which the acquisition partners shape their exchange relations and interactions. It is more likely that acquisition partners adapt their exchange routines whenever they sign an additional collaboration agreement, an action that might flatten their exchange relations and interaction patterns. This kind of cooperation between acquisition partners across their boundaries improves the comprehension of their mutual behavior, strategies and orientations. As a consequence, this helps resolve potential disagreement between the partners, alleviate data gathering costs and problems, and facilitate active learning (Doz, 1996).

The argument mentioned above is based on the fact that acquisition partners develop interorganizational routines through repeated and multiple acquisition activities. Therefore an organization's experience in corporate acquisition activities is more likely to affect its choice of exchange partners. It is worth also mentioning that trust among partners plays an important role in further partnership relations' establishment. As a result, acquiring firms have tendency to benefit from their previous acquisition experience with the same partners in order to minimize any potential source of opportunistic behavior (Gulati, 1995). However, in acquisition context, when target and acquiring organizations accumulate a history of exchange relations and collaboration, the persistence of mutual dynamic capabilities and interorganizational routines is plausibly credible, unlike trust relation between the partners that has to be taken much less for granted. Having mentioned that, experience and familiarity is likely to predict trust (Gulati, 1995) but it is, as Zollo and Winter (2002) reported: "[m]ost probably to breed cooperation and coordination routines among partners, which might in turn generate positive learning effects according to evolutionary economics". All these theoretical arguments and empirical findings suggest my "*specific partner-experience*" hypothesis:

Hypothesis 2b: An organization's experience in corporate acquisitions affects its choice of network partner.

3. RESEARCH DESIGN

3.1. Data

I consider acquisitions of equity stakes as network ties between electricity companies and I focus on the minority acquisitions (partial ownership), i.e., less than 50% of the equity shares of the target company can be bought by the acquiring companies. I restricted my analysis to the minority acquisitions to make sure that I am dealing with partnership relations rather than full ownership relations; in the sense that two separate companies are maintained after the acquisition event has been accomplished between two companies. The primary data source for

this study is the SDC (Securities Data Company) Worldwide Global Acquisition Database, which contains information on all international and domestic acquisitions events worldwide since 1994. The information on acquisitions' transactions I collected from the database include: the effective date of the transaction, the identity of the firms involved in the acquisitions events, the region of both acquirers and targets firms, the status of the transactions (completed, withdrawn, pending, intended, or unknown), the primary four digit SIC codes for both acquirers and targets, and the name of industry sector for both acquirers and targets. For sampling purposes I focused on three main criteria: First, all the companies (both acquirers and targets) must belong to Industry Group 4911(SIC): "Electric Services": Establishments engaged in the generation, transmission, and/or distribution of electric energy for sale. In other words I focused on the within -industry group relations rather than the inter-industry group relations. Second, all the companies should be publically traded which simplified my task to collect financial variables on each company included in the sample. Third, the status of the transactions has to be effectively "completed" rather than just "announced." My study sample includes information on 2240 equity investment events among 223 companies operating in 40 countries and across five continents during the period 1994-2004. I coded the acquisitions' transaction data as one-mode network matrix. The 223 selected firms constituted the actors of my networks. The eleven network matrices constructed for each year over the period of analysis were 223 by 223 square matrices. These matrices are binary; where I put 1 in the cell (ij) if there was an acquisition event between firm i and j, or 0 otherwise. As the unit of analysis is the dyad, all possible combinations of dyads are included; N*(N-1) dyads for yearsm1994-2004, where N=223. Figures 1 and 2 respectively show the number of network ties generated by the acquisition decision from 1994 t0 2004 and the pattern of acquisition network ties change between subsequent observations across the period of study.

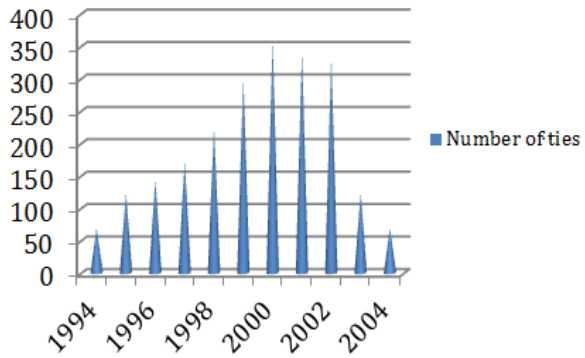


Figure-1. Network ties generated by capital investment decision.

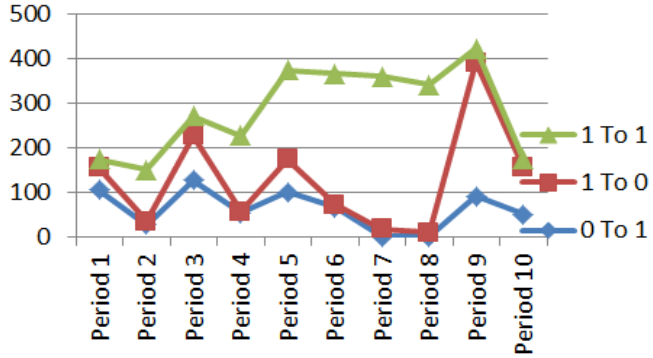


Figure-2. Tie changes between subsequent observations.

3.2. Empirical Model Specifications

Representing simultaneous changes in network structure and organizational performance involves empirical specification of stochastic actor-oriented models. Observed changes in network structures and performance are viewed as joint outcomes of a series of individual choices and selection processes are modeled as changes in network structures depending on the current joint network and performance constellation, while simultaneously influence processes are modeled as changes in performance depending on the joint network and behavior constellation. In the specification of this stochastic actor-oriented model I follow the analytical strategy proposed, and explained in detail, by Snijders *et al.* (2007;2010).

The stochastic actor-oriented model expresses the observed changes between the observations as the result of many small changes in either network ties or performance where each change constitutes a new network-performance constellation that provides the contemporaneous context and values of the explanatory variables for the next change. At random instants, actors get opportunities to make small changes to either their own network neighborhood (e.g., acquisition transaction), or to their own behavior (e.g., performance). These small changes are called "micro steps". A network micro step consists of the opportunity to add or delete one outgoing tie, i.e., actors

can select a new or de-select an existing network partner. A behavioral micro step consists of the opportunity to increase or decrease the behavior score by one unit, provided such a step does not leave the permitted range. Both types of micro steps are modeled in a probabilistic choice framework and can be interpreted as maximization of underlying objective functions which include random disturbances. The opportunity to make behavioral or network changes "micro steps" is determined by stochastic waiting times with expected values determined by rate functions. To obtain an optimal attribution of what drives the endogenous changes in networks and in performance, it is desirable to include a relatively large number of control variables in either process (Snijders *et al*., 2007;2010).

4. VARIABLES AND MEASURES

4.1. Performance Measure

In the acquisition literature, the most frequent manner of measuring a firm's acquisition performance is through the use of accounting and financial indicators (Byrd and Hickman, 1992; Hayward and Hambrick, 1997; Finkelstein and Haleblian, 2002). The main advantage of the use of accounting and financial measures of performance is that they are widely accessible for many organizations and they provide enormous information about a firm's operations. For these reasons, research in strategy and strategic management mostly focused on the impact of strategy on a firm's financial performance. Accounting approaches to characterizing a firm's performance often rely on ratio analysis. In this paper I use one of the most important accounting ratios to measure my organizational performance variable which is the return on assets. Return on assets (ROA): specifies the return that a firm is producing on its investments. It constitutes a fundamental ratio for firms looking to undertaking a new project or taking a strategic decision. This ratio helps companies that are envisaging a new project determine and predict the potential return on its initial investment. Commonly measured each year, ROA reflects typically the stability of the management of a given firm and determine its capability to generate profits. I collected this information for each company in my sample during my period of study from the online COMPUSTAT database.

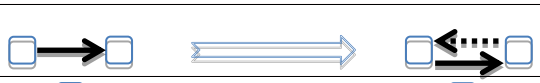
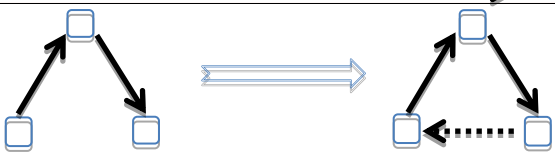
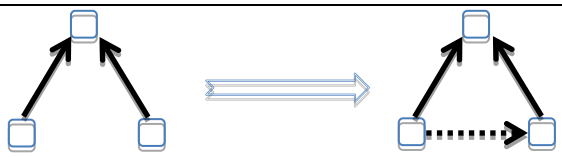
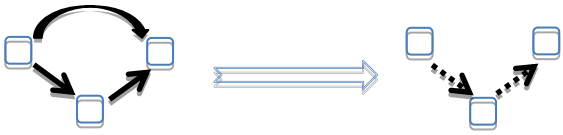
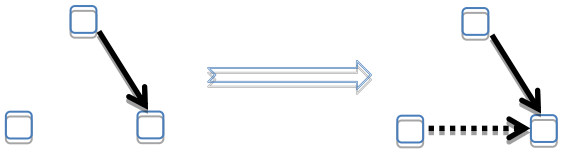
4.2. Endogenous Effects on the Network Structure (Control Variables)

These covariates are included to control for well-known tendencies of networks to self-organize into a variety of local configurations. Endogenous network effects include: (i) density (out-degree) to control for the latent tendency of organizations to have outgoing ties (i.e., to invest); (ii) reciprocity to control for the tendency for organizations to engage in reciprocated investment relations (cross-holdings). Following studies on interorganizational networks (e.g., Lomi and Pattison (2006)) I also allowed for the presence of more complex (triadic) dependencies by controlling for:(iii) transitivity, (iv) brokerage, which indicates the preference for keeping other at distance 2, and (v) structural equivalence, the tendency of organizations to select partners occupying the same network position. Finally, I controlled for (vi) popularity of alters to capture the preference of individual electricity companies to invest in popular other companies. Table 1 defines and describes those network dependency mechanisms along with their effective transition within the acquisition network.

4.3. Exogenous Effects (Control Variables)

As I am especially interested in the relation between network relations and organizational performance, I collected the following variables over the period 1994-2004 given their potential influence on the network structure of acquisitions in the electricity industry. A total of nine control variables were collected, coded, and included in this study: 1/ *Electricity generation*: to look at the similarities in electricity generation between the acquirer and the target company. 2/ *Gas production*: as gas counts as input in for the electricity production, it is important to look at the similarities in gas production between the acquirer and the target company. 3/ *Fixed assets*: this variable is collected at the individual companies' levels in order to control for the sizes of the companies in my sample.

Table-1. Endogenous effects for modeling network evolution.

Network	Effective transition in network	Verbal description
Out-degree (density)		Preference for ties to arbitrary partners
Reciprocity		Preference for reciprocated ties
Transitive triplets		Preference for being partner of partners' partners
Balance (Structural equivalence)		Preference for ties to structurally similar partners
Actors at distance 2		Preference for keeping partners at distance 2
Popularity alter		Preference for attaching to popular partners

For effect statistics see (Snijders *et al.*, 2010).

4/ *Average electricity price*: this variable is collected at the countries' levels. It reports the average electricity price ((households price + industrial price)/2) in the 40 countries included in my sample to look at the similarities in electricity prices between the acquirer and the target company. 5/ *Net Income*: this variable is collected at the individual companies' levels in order to control for the pre- and post- acquisition financial situation of the companies in my sample. 6/ *Geographic proximity*: it states the continent to which the electricity company belongs. I want to investigate whether the geographic proximity has an influence on the acquisition decisions undertaken by acquirers. 7/ *Deregulation*: I believe it is a very important variable that has to be controlled for since deregulation was one of the most important factors influencing acquisitions in the electricity industry after it has been deregulated. I measure it via the number of years since the national market corresponding to each company has been deregulated. 8/ *Public ownership*: this variable takes into account public ownership. Actually, although deregulation triggered privatization and competition, some companies were acquired by public companies. Therefore, in order to discriminate public from private companies, I constructed a dummy variable where I put 0 for public and 1 for private companies. 9/ *Ownership concentration*: This variable captures the percentage of shares sold by the target companies that are owned by the largest four acquiring companies. Generally, low values of CR4 (less than 40%) are indicators of a very competitive industry in the sense that the four largest acquiring firms purchased less than 40% of the target company's shares. That means that other companies are competing but none of them owns a large proportion of the target company's shares. It is measured via the concentration ratio CR4 given by the following formula: $CR4 = S1 + S2 + S3 + S4$, where Si = shares owned by i^{th} company. The sources of these variables are: the World Bank Group Data Base, the Energy Information Administration website, the online official energy statistics from the US government, and the online COMPUSTAT database.

4.4. Independent Variables (Theoretical Variables)

10/ Cumulative number of events: represents the cumulative number of acquisitions' events in which the acquirer company has been involved in previously. I used this measure to test my leaning hypotheses. 11/ *Risk/uncertainty*: I

looked at the organizational uncertainty for both acquiring and acquired firms and I used the coefficient of variation of the ROA to measure it: Uncertainty $_{(ROA)}$ = Standard deviation $_{(ROA)}$ /Mean $_{(ROA)}$.

Table 2 and Table 3, respectively, summarize the main descriptive statistics for the independent/control variables included in the model, and the correlation coefficients among pairs of independent/control variables.

Table-2. Independent and Control variables descriptive statistics.

Variables	Mean	Minimum	Maximum	St. deviation
Cumulative number of events	3.381	0	72	4.986
Fixed assets	11124.67	0	377978	34227.27
Net income	703.928	-6985	30038	2064.77
Electricity generation	1084.501	2.724	3979.043	1341.369
Gas production	4.736	0	22.968	7.918
Risk/uncertainty (ROA)	-0.03	-14.666	24.666	1.126
Risk/uncertainty (RE)	-0.034	-16.5	27.75	1.267
Average electric price	0.067	0.018	0.162	0.03
Deregulation	4.52	0	11	3.283
Public ownership	0.849	0	1	0.357
Ownership concentration(CR4)	0.425	0.05	0.75	0.43

Table-3. Correlation matrix.

Control/independent variables		1	2	3	4	5	6	7	8	9	10	11
Cumulative number of events	1	1										
Fixed assets	2	0.001	1									
Net income	3	0.012	0.372	1								
Electricity generation	4	-0.04	0.251	0.421	1							
Gas production	5	-0.21	0.102	0.209	0.651	1						
Risk/uncertainty (ROA)	6	0.251	-0.11	-0.22	-0.24	-0.01	1					
Risk/uncertainty (RE)	7	0.31	-0.29	-0.31	-0.19	-0.07	-0.11	1				
Average electricity price	8	0.261	0.31	0.004	0.283	0.21	0.31	0.031	1			
Deregulation	9	0.321	0.001	0.004	0.061	0.261	0.012	0.119	0.086	1		
Public ownership	10	0.002	-0.03	-0.03	-0.17	0.009	-0.28	-0.18	-0.08	0.452	1	
Ownership concentration	11	-0.06	-0.19	-0.06	0.062	0.256	0.007	0.107	-0.02	0.621	0.241	1

5. RESULTS

I organize the presentation of my results around the estimates reported in Table 4.

To construct my models, I proceeded as follows: first of all, I estimated a very basic model 1; in which I included only the intercept effect and the endogenous network effect (reciprocity, transitive triplets, balance, number of actors at distance 2 and the in-degree popularity). It is usually advisable to start with a simple model that includes the main network endogenous effects in order to investigate how the network dynamics looks like and after that add the effects of covariates (Snijders *et al.*, 2007). The density (out-degree) parameter captures the general propensity of organizations to be involved in their network by having outgoing network ties (dyadic connection). It is more likely to be negative and significant, which is true in my case (-5.163, p-value<0.01) indicating that the formation of a new tie (acquisition) is costly for each firm involved in the network. Reciprocity is the tendency for organizations to reciprocate a relationship (i.e., shared ties between dyadic partners). Unlike friendship networks for example, where this parameter is expected to be positive, in the case of acquisitions I did not expect reciprocations in ties between firms because of the nature of the tie itself. For one firm, that buys some shares in firm j, this does not imply a reciprocated tie from j to i, and this was confirmed by the result in model 1. Whilst transitivity or transitive triplet summarizes the tendency for organizations to establish transitive triadic

relations (i.e., friends of my friends are friends), the geodesic distance-2 represents the tendency for organizations to form indirect ties to others through one intermediate organization.

Table-4. Models and parameter estimates (Standard errors in parentheses).

Network dynamics	Model 1	Model 2	Model 3
Out-degree (density)	-5.163**	-5.088**	-6.328**
	(0.233)	(0.576)	(0.276)
Reciprocity	0.524	0.233	0.406
	(0.348)	(0.350)	(0.414)
Transitive triplets	1.156**	1.215**	1.130**
	(0.164)	(0.422)	(0.235)
Balance (structural equivalence)	-0.167**	-0.209**	-0.179**
	(0.020)	(0.028)	(0.036)
Number of actors at distance 2	-0.231**	-0.194*	-0.218*
	(0.054)	(0.088)	(0.091)
In-degree (popularity)	0.875**	0.580**	0.981**
	(0.126)	(0.127)	(0.151)
Common continent		1.550**	1.498**
		(0.155)	(0.162)
Electricity generation similarity		-0.220	-0.113
		(0.302)	(0.325)
Gas production similarity		-0.594*	-0.616*
		(0.236)	(0.234)
Average electricity price similarity		0.658**	0.619**
		(0.182)	(0.185)
Fixed assets similarity		0.620	0.477
		(0.578)	(0.618)
Net income similarity		-1.285	-0.804
		(0.899)	(0.955)
Public ownership similarity		-0.289	-0.188
		(0.171)	(0.149)
Ownership concentration alter		0.050*	0.050*
		(0.024)	(0.015)
Ownership concentration ego		0.044	0.036
		(0.024)	(0.020)
Ownership concentration similarity		-0.172	-0.116
		(0.681)	(0.664)
Deregulation alter		-0.185	-0.171
		(0.1450)	(0.140)
Deregulation ego		0.034	0.038
		(0.047)	(0.043)
Deregulation similarity		3.312**	2.980**
		(0.530)	(0.492)
Cumulative number of events alter			-0.030
			(0.032)
Cumulative number of events ego			0.044*
			(0.012)
Cumulative number of events similarity			2.927**
			(0.782)
Risk/Uncertainty alter (CV of ROA)			-0.028
			(0.053)
Risk/Uncertainty ego (CV of ROA)			0.138*
			(0.065)
Risk/Uncertainty similarity (CV of ROA)			2.668
			(1.916)

Note: Standard errors are in parentheses. **=p<.01 * = p<.05.

The transitivity effect parameter was positive and highly significant (1.156, p-value<0.01) while the geodesic distance-2 parameter was negative and also significant (-0.231, p-value<0.01). Interpreted together, the effects of

transitive triplet (positive) associated with the effect geodesic distance-2 (negative) are indicators of network closure tendencies, i.e. partners of partners tend to be partners (Snijders *et al.*, 2010). The balance parameter captures structural equivalence which refers to the tendency of creating and having ties with other companies that establish the same acquisitions' choice as ego (Snijders *et al.*, 2010). It is also defined as the similarity between the outgoing ties of company i and the outgoing ties of the other companies j to which i is linked. Burt (1987) reported that "[t]he structural equivalence model highlights competition between ego and alter. This includes, in the extreme, the competition of people fighting one another for survival but applies more generally to the competition of people merely using one another to evaluate their relative adequacy". Subsequently, structurally equivalent firms occupy identical and are very similar in their social network to the level that they experience the same configurations and patterns of relations with tenants of different positions in the network. This parameter was negative and highly significant (-0.167, p-value<0.01). Therefore, one plausible interpretation could be that electricity companies are competing for acquiring shares from attractive and performing others in a deregulated electricity industry. In fact, the negative balance parameter shows that two electricity companies that compete do not acquire shares from each other even if they are both acquiring shares from a third common partner. The in-degree popularity parameter was positive and significant (0.875, p-value<0.01) which means that there is more tendency for acquiring companies to acquire shares in companies whose shares were acquired in the previous period by several other electricity companies. This indicates that these target companies were very attractive for shares' buyers. The various triadic network effects representing transitive closure show that this actor-based model allows great flexibility in expressing the complex dependencies that are characteristic for network dynamics (Snijders, 2001), (Snijders *et al.*, 2007;2010).

In model 2, in addition to the structural network effects I tested in model 1, I included the control variables to capture the impact of the individual electricity companies' attributes on the acquisition networks dynamics and on the network selection process. I reported a positive and significant geographic proximity parameter (1.550, p-value<0.01) which means that the likelihood of companies that belong to the same continent to be involved in acquisition transactions is higher than those belonging to different continents. This result might be related to transaction cost reduction sought by acquiring companies or also to the political environment and the bilateral laws within the same continent (like in the European Union) facilitating foreign investments. The gas production similarity parameter was negative and significant (-0.594, p-value<0.05) which indicates that there is a tendency of acquiring companies to acquire shares from others using different technologies in the electricity generation process. In fact, gas has been used for long time as an input for the electricity production but does not constitute the only source exploited since several other sources are used such as, coal, petroleum, hydroelectric, wind, nuclear, and solar energy. I also reported a positive and significant effect of average electricity price similarity (0.658, p-value<0.01). This result could be explained by the fact that in cross border electricity acquisitions, acquiring companies are targeting companies in countries where the electricity price is comparable to their focal national average price. For the ownership concentration variable I found a positive and significant receiver effect (0.050, p-value<0.05) which means that the higher the ownership concentrations of the target company the higher the likelihood that the other companies will try to acquire shares from it. This result is perfectly harmonized, in particular with the structural effect "in-degree popularity" that was also positive and significant, and highlighting that popular alters are more suitable as potential partners, and in general with the competitive nature of the deregulated electricity industry in the sense that companies compete to acquire shares from attractive and common others. Finally, the deregulation similarity parameter was positive and significant (3.312, p-value<0.01). This result was definitely expected and shows that companies operating in deregulated countries were involved in acquisition transactions during my period of study.

Finally, in model 3, I added my two main theoretical variables: opportunity for learning measured by the cumulative number of acquisition events an organization had been involved in the past and the uncertainty

measured by the coefficient of variation of organization's returns on assets. For both of them, I checked for ego (sender effect), alter (received effect) and similarity (homophily effect). For the uncertainty variable, I reported a positive and significant ego parameter (0.138, p-value<0.05). This result supports my first hypothesis stating that the higher an organization's uncertainty the higher the likelihood that it will engage in corporate acquisition activities. For the opportunity for learning variable that I define in terms of cumulative number of acquisition events, I reported a positive and significant ego parameter (0.044, p-value<0.05) and a positive and significant similarity parameter (2.927, p-value < 0.01). Both results confirm my second hypotheses (2a and 2b) stating that the greater the cumulative number of acquisition events in which a company has been involved in previously, the higher the likelihood that it will engage in further acquisition events in the future, and that electricity firms take into consideration organizational experience when choosing their network partners.

6. DISCUSSION AND CONCLUSION

Although it is very common in the organizations literature to find studies deriving consistent results of the effects of learning on the likelihood of interorganizational relationships (e.g., acquisition), further developments emphasized that "learning by doing" represents only a mechanism for learning. He explained that routinized actions and accumulated experiences are not sufficient to explain organizational learning processes and to manage future partnerships relations (e.g., acquisition). Trying to bridge the cognitive and behavioral views to the organizational learning models, Zollo and Winter (2002) argued that organizations must invest effort and time in order to develop dynamic learning capabilities and collective competences. They also attended to more deliberate processes implying the "articulation and codification of knowledge" obtained from evidence and reflection upon previous experiences (Zollo and Singh, 2004). In other words, organizations cannot learn only by accumulating previous experiences and doing more the same as it is most common in the organizational literature, but they "[l]earn directly by articulating and codifying the lessons they learned from previous experiences, even if they might not be aware of the positive learning spillovers from these activities" (Zollo and Singh, 2004). Consequently, although this study is aligned with the huge received literature on organizational learning that focuses on accumulated experiences and routines as principal predictors of interorganizational relations, I acknowledge its limitation in the sense that it does not take into consideration the new development of organizational learning theory and the notion of deliberate learning processes (Zollo and Singh, 2004) as contrasted to "learning by doing" argument.

For my learning experience hypothesis, I argued in the theoretical part of this paper that an organization's experiences affect its choice of acquisition of network partners and I reported a positive parameter of the variable "cumulative number of acquisition events similarity". Hence, I found that organizations are more likely to acquire shares in others experiencing similar levels of experience. My finding supports the idea that organizational experience similarity breeds connections through acquisition activities. However, this result is different from many other findings in the organizational learning literature that have produced contradictory results by showing that difference in experiences breeds connections. For instance, Beckman and Haunschild (2002) proposed that organizations that are not able to learn from their own limited experiences are more likely to look for network partners having diverse experiences. Also, Greve (2005) in his study of the impact of alters' innovation on the likelihood of interorganizational ties' formation reported that "[I]nter-organizational learning is a distinctive form of learning because the organization learns from the experience of others rather than from its own experience". So, conversely, these studies have shown that organizations linked to others with heterogeneous experiences are in a better position to learn from this situation than organizations linked to others with homogenous experiences.

In summary, focusing on acquisition events involving companies in the international electricity industry, I specified and estimated dynamic network models for social selection. Based on resource dependence theory, I reported clear evidence that uncertainty, as measured by the coefficient of variation of performance, increases the likelihood that companies will engage in corporate acquisition activities. Based on organizational theory, I found

that accumulation of previous acquisition experiences positively affect the likelihood of further acquisition activities and that organization's acquisition experience has an impact on its partners' choice. Implications of these results might be of value for research on the micro-relational mechanisms underlying the observed structure of interorganizational fields.

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