THESIS ON ECONOMICS H11

European Network Governance – Corporate Network Systematic in Germany, the United Kingdom and France: an Empirical Investigation

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Declaration:

I hereby declare that this doctoral thesis is my original investigation and achievement, submitted for the doctoral degree at Tallinn University of Technology and has not been submitted for any degree or examination.

Jochen Heubischl

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MAJANDUS H11

Euroopa haldusvõrgustike koordineerimine – korporatsioonide võrgustike süsteem Saksamaal, Ühendkuningriigis ja Prantsusmaal: empiiriline uuring

JOCHEN S. HEUBISCHL

To my dear parents, Ingrid and Gerhard,
for their love and support.

*"**Corporate governance is a global issue now demanding local focus.**"*

(John Connolly, president and chief executive of Institutional Shareholder Services, the US-based proxy voting adviser, in: Financial Times, December 20, 2004)

Abstract:

In this work the purpose is to investigate the underlying structural logic of pre-defined governance networks prevalent in Germany, the United Kingdom and France. Therefore we utilize an exponential random graph model for uni-modal directed social networks pre-defined for these three network economies, thereby addressing a variety of substantive questions about the governance microstructure prevalent in the respective corporate landscape. P* model is used to identify local regularities in the interlock between enterprises; a discrete triad-analysis of the respective partial networks established by institutional corporate ties, that is, interlocking directorates and interlocking ownership, between a set of the largest business enterprises forming the total network of power relations in the respective countries is performed.
This paper scrutinizes the general hypothesis that interdependencies between shareholdings and the exertion of personal control does exist. Based on this assumption, further hypotheses are derived concerning the fundamental structural patterns of corporate governance and tested empirically.
We propose that tendencies in triadic microstructure reveal conclusions about the corporate inter-firm behaviour and strategy with respect to the firms' dyadic and triadic formation and competitive implications here from, as well as social influence and social selection within the defined samples, given the distinguishing characteristics of the respective corporate governance system in Germany, the United Kingdom and France. The results gain importance given a changing corporate market as a result of an intensified competition within the ongoing process of globalisation leading to rising power of inter-organizational networks in globalizing markets in recent time. Thus, a comprehensive analysis of the systematic of the triad microstructure in the network economies included in this study is an essential contribution to research.

Key words

Corporate Governance; interlock network; social network analysis; random graph;

Germany; France; United Kingdom.

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LIST OF NOTATIONS

$N = \{1.2.\ldots.n\}$	Set of actors of a social network, no. of actors
$M^{\#}$	Set of all possible ties in N
M^{P}	Set of directed interlocking directorates (subset of possible ties)
V^{P}	Set of directed interlocking directorates, dichotomised (subset of possible ties)
M^{C}	Set of directed ownership ties (subset of possible ties)
O^{P*}	Outdegree Max. (Personal Network)
O^{C*}	Outdegree Max. (Capital Network)
M	Set of mutual dyads (subset of possible ties)
R	Set of sociometric relations
X	Set of ordered pairs of actors
$x_{i,j}$	Observed tie between actors i and j
$x = \lfloor x_{ij} \rfloor$	$n \times n$ (binary) array x denoting an observed network on N
X_{ij}	Random variable for the possible tie (i, j) between actors i and j
$X = \lfloor X_{ij} \rfloor$	$n \times n$ (binary) array X denoting a random graph or network on N
$\Pr(X = x)$	Probability that the random network X is equal to x
m	Type of relational tie
i, j, k	Any actor within a social network
β , θ	Regression coefficient, model parameter
x , z	Explanatory variable in regression analysis
ε	Random error term in regression analysis
df	Degree of freedom (F-distribution)
L	Log likelihood
LR	Likelihood ratio statistic
δ	Log odds ratio
κ	Normalizing quantity
PL	Pseudo-likelihood
ϖ	Logits
p, q	Variable(s)
λ	Acceptable level for the proportional change in predicted probabilities
T	Triad
$\Im$	Set of all possible triads
$\propto$	..is proportional to..

ABBREVIATIONS

AFG	Association Française de Gestion Financière
AG	German Public Company Limited by Shares (Aktiengesellschaft)
AktG	German Stock Companies Act (Aktiengesetz)
App.	Appendix
ASFFI	Association Française des Fonds et Sociétés d'Investissements
CEE	Central and Eastern Europe
CEO	Chief Executive Officer
CG	Corporate Governance
Co.	Company
Col.	Column
Corp.	Business Corporation (United States)
DAX	Deutscher Aktienindex
Diss.	Dissertation or Ph.D. Thesis
e.g.	for example (exempli gratia)
ECGI	European Corporate Governance Institute
Ed. / Eds.	Editor(s)
Et al.	Et aliquid (lat.)
F	France
FTSE	Financial Times Stock Exchange
G	Germany
GDP	Gross Domestic Product
GmbH	German Limited Company (Gesellschaft mit beschränkter Haftung)
GSM	General Shareholder Meeting
HGB	German Commercial Code (Deutsche Handelsgesetz)
Habil.	Habilitation
I.e.	Id est
Inc.	Business Corporation
IOR	Inter-organizational Relationship
KGaA	German Association Limited by Shares (Kommanditgesellschaft auf Aktien)
KStG	German Corporation Tax Law (Körperschaftssteuergesetz)
KZfSS	Kölner Zeitschrift für Soziologie und Sozialpsychologie
Ltd.	British Private Company Limited by Shares

Abbreviations: Continued

MEDEF	Mouvement des Entreprises de France
MNE	Multinational Enterprise
No.	Number
NV	Public Company Limited by Shares (Naamloze Vennootschap)
p. / pp.	page(s)
PDG	Président-Directeur Général
Plc	British Public Company Limited by Shares
S.A.	Stock Corporation (Société Anonyme)
S.A.R.L.	Limited Company (Société à Responsabilité Limitée)
SNC	Ordinary Partnership (Société en Nom Collectif)
UK	United Kingdom or Great Britain
Vol.	Volume
WO	Wholly owned
Y/N	Yes / No
ZfB	Zeitschrift für Betriebswirtschaft
ZfbF	Schmalenbachs Zeitschrift für betriebswirtschaftliche Forschung
ZFO	Zeitschrift für Führung + Organisation
ZIP	Zeitschrift für Wirtschaftsrecht und Insolvenzpraxis

1 INTRODUCTION AND RESEARCH STRATEGY

In last years Corporate Governance (CG) has come into the focus of corporate boardroom, political and public discussion around the globe thus becoming a mainstream concern restricted not only to scholars and shareholders.[1] Corporate Governance features a wide research field raising a number of issues to which economists, legal experts, political scientists, and sociologists all have made numerous contributions.[2] The discussion about network structure of country-specific CG systems and the environmental conditions around corporate networks focus the interest on CG.[3] However, it is not the purpose to comment on all the issues raised in this research field; instead this paper rather pays attention to one specific issue in this field with a particular focus on the governance systematic of corporate networks.

Today, the modern economy is characterised by a growing dynamic and a high level of globalisation, integration and deregulation. In an increasingly interconnected and interdependent world with globalisation of markets, production and sources enterprises are becoming deeply intertwined with each other. There is an increasing acknowledgment that organizations typically operate in a relational context of environmental interconnectedness and that an organization's survival and performance often depend critically upon its linkages to other organizations. Thus, the question behind all that could be raised is the following: Do firms organized in networks have higher survival chance than do firms which maintain arm's length market relationships? The ongoing globalisation process not only in the "European networked economies"

[1] CG has gained renewed interest in the wake of corporate scandals and corporate failures all over the world as well as financial crises in the last years (see Küsters, E. A. (2002), p. 311 f; Wulfetange, J. (2002), p. 83 ff). Beyond, globalisation and the integration of markets as well as growing competition have enforced the debate on Corporate Governance on an international level. Additionally, the CG discussion continuously gains impulses due to a dynamically changing business environment. For example, globalisation of capital markets, the increasing relevance of stock markets used as form of financing and the risen influence of institutional investors as well as the public on the corporate management (see Matthes, J. (2000), p. 28 ff; Wulfetange, J. (2002), p. 84 ff).

[2] The term CG is not a standing term of one single research field, but could be rather understood as an expression broadly discussed in several areas on an interdisciplinary level (Schneider, U. / Strenger, C. (2000), p. 106). The absence of any real consensus on the definition of CG in the rapidly growing literature on the subject, here, is symptomatic of the whole CG debate (see Keasey, K. / Thompson, S. / Wright, M. (1997), p. 2).

[3] Comparative studies regarding different CG specifications in selected countries are, for example, Chew (1997), Hopt et al. (1998) and Windolf (2003). The latter author additionally discusses on the ongoing competition of CG systems. The discussion if there is a best approach of governance system that would deliver superior national performance still remains unanswered in science.

might give support to this statement resulting in intensified competitive conditions in a more global competitive market.

Moreover, the increased volatility of corporate ownership portfolios observed in last years,[4] have led to renewed interest in ownership structures, especially with respect to Multinational Enterprises (MNEs). As the economies of the world become more and more globally integrated, these are the kinds of issues we can expect to face in striving to understand the interweaving system of corporate relations establishing formal as well as invisible networks of power. To approach these questions, this study adopts the perspective and methodology of inter-firm network research.

1.1 Subject of Study

1.1.1 Introducing the Gap and the Research Problem

Within the system of corporate governance, companies exert mutual control by the delegation of managers to the top management of other companies as well as by cross-capital ownership. Among the broad research within this academic field, scientists dealt with the distribution of power and control in networks in a number of countries. In this regard, the structural characteristics of governance networks are intensively, widely and critically discussed many times in a number of countries either from a historical and comparative perspective.[5]

A common problem in sociology and management science is the comparison of (dyadic) relational structures, i.e. graphs. Where these structures are formed on a common set of elements, a natural question which arises is whether there is a tendency for elements which are strongly connected in one set of structures to be more - or less - strongly connected within another set.[6] Although there has been much work on the description of the structure of inter-organizational networks analysing the connective

[4] The literature examining the motives and firm level consequences of portfolio restructuring during this period is equivocal, but the dominant image is of increasingly focused firms that are more efficient, better positioned to compete internationally, and provide improved returns for shareholders (see Blair, M. (1993); Shleifer, A. / Vishny, R. W. (1992)).

[5] For international comparative studies see, for example, Windolf, P. / Beyer, J. (1995), Windolf, P. / Nollert, M. (2001), Wald, A. (2003) and Windolf, P. (2003).

[6] See Butt, C. T. (2005), p. 1.

topography between interlocking corporate organisations, only very limited scientific research has been conducted focusing on the structural logic of corporate relationships and resultant impacts. Scholars have studied inter-firm networks at multiple levels of analysis, including the dyad,[7] the ego network,[8] and the overall network.[9] However, less attention has been paid to triads and triadic structure,[10] an important aspect of inter-organizational networks. But, in fact, there is a growing need to understand how social structures in the Europe, and in particular in European network economies, are formed.[11]

Regarding the structural logic of social networks, there is clearly more research needed and we make some suggestions for this. We argue that governance networks are not a product of coincidence but rather a result of numerous institutional-functional complementary that have emerged over a long period.[12] In the present study we take on this conceptual consideration.

1.1.2 Towards a Closure of the Gap

In this work the purpose is to explore the underlying structural logic of pre-defined governance networks prevalent considering the total corporate landscape respectively in Germany, France and the United Kingdom.

The aim of this particular study is to find answers to the following research questions:

- What structural tendencies in triadic microstructures can be observed in the respective institutional networks of corporate power in the countries of interest and what are their implications?
- How can actors' inter-firm behaviour regarding dyadic and triadic formation be interpreted given the main characteristics of the respective corporate governance system?

[7] For example, Gulati, R. (1995).
[8] For example, Gomes-Casseres, B. (1996).
[9] Gulati, R. / Gargiulo, M. (1999).
[10] Triads are subsets of three network actors and the possible ties among them forming a finite number of specific network configurations (for more see Chapter 2.4).
[11] See above.
[12] Heinze (2002) has established this argument with regard to the German network (see Heinze, T. (2002), p. 4).

We utilize an exponential random graph model - commonly referred to as p* model - for our purposes,[13] thereby addressing a variety of substantive questions about the governance systematic and actors' network configuration. The advantage of this class of probabilistic models is that they model global network structure as the outcome of processes occurring in local social neighbourhoods of the network.[14] By this means, a discrete analysis of triadic microstructure of the partial networks established by personal and financial linkages between a set of selected large-scale business enterprises forming the respective total network of power relations for each country is performed. A key goal in triadic analysis is to understand why certain patterns of tie formation occur and, in particular, to understand what the likelihood of observing triadic network configurations is and what factors explain their occurrence. In "graph-theoretic" terms, this approach implies discerning structural tendencies in observed networks.[15] This approach seems reasonable in terms of a full description of the network system given the fact that the commitment and maintenance of personal and capital relationships between actors are not independent. Studies with regard to only one type of relationship might comprise only constrained statements.

This paper scrutinizes the general hypothesis that interdependencies between ownership ties exist as well as between the exertions of personal control. Moreover, it could be assumed that inter-organizational relationships (IOR) are developed either on the basis of financial participation or personnel delegations. For the investigation of the structural logic of the respective networks the basic consideration is as follows: the individual inter-organizational relations[16] within a governance system are not independent from each other. I.e. the decision whether a company enters into a power relation with another company by the delegation of a manager or interlocking

[13] See Frank, O. / Strauss, D. (1986), Wasserman, S. / Pattison, P. (1996, 1999), Robins, G. / Pattison, P. E. / Wasserman, S. (1999).

[14] A local social neighbourhood can be construed as a set of network tie variables that are hypothesized to be mutually conditionally interdependent (see Pattison, P. E. / Robins, G. (2002), p. 301 f).

[15] Graph theory, a mathematical system of concepts, theorems, and tools for modelling a network as a set of actors and the ties among them, is the primary foundation of social network analysis (see Wasserman, S. / Faust, K. (1994), p. 93).

[16] Here, restricted to interlocking directorates and shareholder-crossings.

ownership depends substantially on existent further relations of both enterprises to each other.[17]

Further hypotheses are derived concerning the fundamental structural patterns and triadic microstructure - the logic of corporate governance - and tested empirically for the prevalent governance networks in three separate country studies. Thus, our goal is to advance analysis on both conceptual and methodological fronts.

The aim of this study is to explore the nature of governance structures between German, French and British companies under increasing competition and internationalization. The purpose hereby is to show how corporate (economic) power is distributed in the governance networks in major European countries. In other words, how are firms in network economies in Europe with different models of corporate governance operating organised and governed? Further issues that can be derived by the use of predictor variables in exponential random graph models are aspects of social influence and social selection within the pre-defined network. This paper attempts to shed light on these issues by describing in detail the important characteristics of the corporate networks established by the major corporate players in Germany, the United Kingdom, and France as well as examining the network systematic prevalent in those networks - in particular, the likelihood of observing triadic network configurations is estimated - in order to analyse corporate (network) governance. The empirical results reveal conclusions regarding corporate behaviour and corporate strategy, more precisely, the actors' inter-firm behaviour with respect to dyadic and triadic formation, social influence and social selection and competitive implications of triad structure for the respective samples given the respective characteristics of the distinguishing corporate governance system.

The results gain importance given a changing corporate market as a result of an intensified competition within the ongoing process of globalisation. Thus, a comprehensive analysis of the systematic of these network economies is an essential contribution to research, given also the fact of the rising power of inter-firm networks in today's markets. Given that both theoretical interest in governance in inter-firm network triads and the log-linear statistical model we employ in particular are relatively recent,

[17] It should be explicitly stated that the center of investigation is the firm, and the rule of the game focus around top managerial decision-making, which will eventually shape the firm strategy.

we sought to demonstrate their joint utility and potential promise by using network data drawn from large enterprises of European network economies.

The knowledge around the effects and connections of IORs within the control system of enterprises is still limited in science. To large extent hypothesis-testing models for a more comprehensive investigation of the complexity of the network structures as well as its multi-causal logic are still missing. Analyzing the systematic of corporate relations within the network economies a contribution is made to a better understanding of the prevailing, complex inter-organizational network.

The importance of the topic of current work is evident in the fact that corporate governance, in the broader sense of the inter-firm relationships among management and the ownership structure is currently characterised by a structural adaptation process.

The actuality of the theme is evident as there has been almost no previous local research on the topic which allows a comparative perspective.[18] In other words, to our knowledge no such cross-national study on the structural logic of institutional inter-firm networks does exist covering large corporate market samples for the three largest European network economies. Thus, this study is an attempt to contribute to filling the gap in analytic interlock research. Given the large-scale dataset providing a representative sample of the total corporate landscape for the respective economies it can be seen as a cornerstone; in fact, the research and the results could be used as a good base for further researches.

[18] Interest in social networks and use of the wide-ranging collection of social network methodology began to grow at a much more rapid rate within the 90s. Although it is not completely clear what caused it there was some trend to realization in much of behavioural science that the "social context" of actions matter (see Wasserman, S. / Scott, J. / Carrington, P. J. (2005), p. 1).

1.2 Research Design

1.2.1 Research Methodology

Research in this study is done from a base of inter-organizational perspective based around the concept of social networks.[19] We consider network data comprising information about binary relations between large enterprises in three European network economies Germany, France and the United Kingdom, respectively. Descriptive key figures on the empirical mapping of patterns of social relations between these actors – mainly from a whole network study perspective[20] - are presented based on empirical data using the concept of social network analysis, a related social discipline.[21] Those networks usually emanate from top management decisions and are based on a top management (e.g. interlocking directorships) or capital level (e.g. shareholdings, financial interlocking). By collecting empirical data the market and competition based interlock structure of the German, French and British corporate interlock networks are evaluated. Based on the structural features of the networks of power relations the systematic of the network structure is examined in a more comprehensive way.

Following popular and academic conventions, we define a dataset to be a specific number of large publicly held business corporations in the particular economy at a given survey date. Restrictions are set respectively for each country study to guarantee that we provide full consideration of the corporate landscape prevailing in the three network economies. By this means, our conclusions drawn reflect the particular characteristics of

[19] Interest in social network analysis has grown massively in recent years. This growth has been matched by an increasing sophistication in the technical tools available to users that have appeared during the 1990s (see Wasserman, S. / Scott, J. / Carrington, P. J. (2005), p. 1). In their book titled "Models and Methods in Social Network Analysis" Carrington / Scott / Wasserman (2005) present the most important developments in quantitative models and methods for analyzing social network data that have appeared during the 1990s, intended as a complement to Wasserman / Faust's (1994) standard reference.

[20] The broad majority of social network studies use either "whole-network" or "egocentric" designs. Whole network studies are concerned with the structural properties of networks at the global level examining sets of interrelated actors that are regarded for analytical purposes as bounded social collectives, whereas egocentric studies focus on a focal actor and the relationships in its locality. However, egocentric and whole-network designs are interrelated: a whole network contains an egocentric network for each object within it (see Marsden, P. V. (2005), p. 8 f).

[21] Social network analysis has been used since the mid-1930s to advance research in the social and behavioural science and has continuously progressed from thereon (see Wasserman, S. / Scott, J. / Carrington, P. J. (2005), p. 1). We here consider study design and methods for social network studies that have appeared since an earlier review with reference to Marsden (1990).

corporate behaviour and strategy of the corporate players acting in the respective market. Although alternative ways of bounding the network are possible (e.g. other indices), we assume that large firms are well connected to each other in comparison to smaller firms. Criteria of sample selection are also set in order to cover full corporate market, i.e. to guarantee the full description of governance systematic of the respective corporate market.[22]

Subject of study in the present empirical country studies is the pattern of relationships between a set of entities that form part of the corporate network (firm-level data on corporate ties). These patterns of inter-corporate ties are the sphere of network analysis. The general applicability of network analysis is such that the units in a network may be measured at any level: individuals, organizations, or nations. We focus on the inter-organizational level[23] (level of analysis); the unit of observation is a definite set of enterprises in each country.[24] Collecting dyadic corporate relations on each national data set and the global features of the emerging network structures are given prime consideration;[25] unit of analysis are dyads and triads.

Networks of interlocking directorates and ownership links are supposed to be a major element of European Corporate Governance[26], especially in network economies such as

[22] Further description regarding selection, composition and size of the respective sample will be given in each country study separately.

[23] At the inter-organizational level, network analysis charted the effects of networks on firms, industries, and society.

[24] It is not possible to define a distinct boundary of the network (see Bott, E. (1972), p. 216). Based on the argument of Park (1996), we define a group as consisting of a finite set of actors as it meant to be an analytic requirement (see Wasserman, S. / Faust, K. (1999), p. 19). Two general approaches to identify boundaries of the networks can be identified: the positional approach and the reputational approach. For more see Scott, J. (1991), pp. 58-59.

[25] The features of the inter-corporate network play an important role in the structuring of economic power and in wider social processes (see Stokman, F. N. / Ziegler, R. / Scott, J. (1985), p. 2).

[26] As discussed, the research field of CG covers numerous aspects; for the empirical examination in part II of this work, however, we agree upon one focus, in particular, within this broad field. For the purposes of the empirical studies we define the term CG at its most expansive sense stretched to include the entire network of formal and informal relations involving the corporate sector. As governance networks established by interrelationships between firms are in the center of focus and the empirical results might reveal conclusions regarding the corporate behaviour and corporate strategy of the actors the understanding of the term CG is close to the definition of OECD (1999): “Corporate Governance [...] involves a set of relationships between a company’s management, its board, its shareholders and other stakeholders. Corporate Governance also provides the structure through which the objectives of the company are set, and the means of attaining those objectives and monitoring performance are determined.” (see OECD (1999), p. 2).

Germany, United Kingdom and France.[27] By this mechanism, a structure of control is established in the corporate interlock network, long time being less transparent.[28] However, recent regulations and recommendations regarding sound Corporate Governance[29] set up by a number of private organisations or respective government committees in mainly all large industry nations have deepened this field of research to (mainly) academics allowing them to collect full systematic data to comprehensively analyse the structure of interlock webs.

The aim of this empirical investigation of governance networks in the major European countries is - in order to answer the research questions as set out in section 1.1.2 - to analyze how the enterprises are tied together in inter-organizational networks from the viewpoint of a governance perspective with a particular focus on the social local regularities prevalent in the corporate networks in Germany, France and the U.K. The analytic examination of the different network configurations reveals the degree and direction of the individual participant's network integration, thus power constellations within the governance networks in the selected countries are made more transparent.

Further readings[30] will show a research method that is applicable on social networks which examines the underlying structural logic of a structure of a network focusing on dyadic and triadic relations between actors of a network. We test for non-randomness in inter-organizational network data using the recently developed log-linear statistical network model p* *(Wasserman / Pattison, 1996)*, which facilitates a more sophisticated

[27] Corporate governance and structures differ among the advanced economies of the world (see Bebchuck, L. A. / Roe, M. J. (1999), p. 127). Particularly the question on management and control differ between the particular forms of the two basic models of CG systems (see Scheffler, E. (1995), p. 79 f). Different legal systems, the institutional environment and socio-cultural factors in various countries at present no universal model for CG does exist. Consequently, a number of differences between the systems prevailing in the different countries can be identified (see Witt, P. (2003), p. 12), leading to different strategies necessary for the respective actors (for more see Hofmann, R. / Hofmann, I. (2002), p. 86 ff). Corporate governance, or governance structure, is considered here a coherent part of the institutional system that underpins economic life. As such, it can be seen as part of the system that set the rules of the game for managers and other stakeholders who affect strategic decision-making (see Federowicz, M. (2003), p. 9).

[28] The network of interlocks might be largely invisible to anyone who doesn't have the time and experience to read and cross-reference regulatory filings.

[29] A sound system of Corporate Governance is integral to the operation of a competitive, well-functioning market economy. With respect to a broader understanding of the term a sound CG is a set of institutionalized settings and practices that orient the key actors of decision-making towards the sustainable development of the firm (see Federowicz, M. (2003), p. 7)

[30] See Chapter 3.

understanding of the underlying structural logic - the triad microstructure - of the interweaving system of corporate control existent between a set of enterprises. Dependence models, in general, explicitly address the issue of how points and lines are related.[31] The general class of the p* model used, the probabilistic network models can be specified as log-linear models with the log-likelihood function given as a linear combination of some chosen network statistics.[32] The goal of the particular analysis conducted here is to understand what the likelihood of observing triadic network configurations is and what factors may explain their occurrence, thus we might better understand inter-firm triadic microstructure. *Contractor / Wasserman / Faust (1999)* described p* as facilitating the investigation of "whether the observed graph realization exhibits certain hypothesized structural tendencies […] by estimating parameters that quantify the effects of the hypothesized structural property on the probabilities of ties being present or absent in the network."[33] In graph-theoretic terms, p* analysis allows the researcher to assess whether particular graph realizations with theoretically hypothesized properties have significantly greater probabilities of being observed.[34] In practical terms, p* analysis consists of generating a set of predictor variables from a network and then employing logistic regression analysis to fit a series of nested models in which the response variable is the presence or absence of a tie between each pair of actors.

P* techniques (*Wasserman / Pattison, 1996*) can be used to develop a comprehensive analytic framework to specify, and simultaneously test theoretical hypotheses that will help to better explain the emergence of inter-firm networks in 21st century organizational landscape. The p* model, in particular, is suitable for the purpose of the investigation of this study for a number of reasons. In comparison to the traditional approach to the empirical investigation of triads, p* allows for a more systematic and

[31] These are models in which network structure is determined by the latent individual preferences for local linkages (see Wasserman, S. / Scott, J. / Carrington, P. J. (2005), p. 3). Robins / Pattison (2005) point out that dependence models allow the grasping of the variety of ties that enter into the construction of social spaces, and, from this point of view, dependence graphs are to be seen as representations of proximity in social space, and network analysts are engaged in social geometry (see Wasserman, S. / Scott, J. / Carrington, P. J. (2005), p. 6).

[32] See Frank, O. (2005), p. 40.

[33] See Contractor, N. S. / Wasserman, S. / Faust, K. (1999), p. 2.

rigorous examination of triads and triadic structure.[35] Many substantive questions about triads cannot be answered by focusing on triads alone;[36] p* makes it possible to adopt the multilevel approach that is therefore needed. Secondly, questions related to variation in actors' proclivity to engage in certain types of triadic activity, such as transitivity, necessitate statistical models such as p*, which take into account the fact that triads are not independent of each other.[37] *Wasserman / Robins (2005)* see great value of p* models as making possible an effective and informed move from local, micro phenomena to overall, macro phenomena.[38]

1.2.2 Data Gathering Process

The purpose is to examine the current state of the systematic of personal and capital networks established by German, French and British large-scale, stock-listed enterprises in separate country studies.[39] It was decided to collect sociometric data with 2005 as the target year (as of 01.01. of the year). A restriction to a nation's largest enterprises is reasonable because between them contrary to small and middle enterprises multiple entwinement relations can be expected. The dataset is restricted to stock-exchange listed enterprises due to prevailing announcement regulations for these companies in all three economies which ensures a problem-free entrance to systematic data, thus a completeness of the data is guaranteed.[40]

The purpose is to investigate existent personal and capital relations between a set of companies defined for each country. The restriction on the partial networks of

[34] See Contractor, N. / Wasserman, S. / Faust, K. (2003), p. 9.
[35] See Wasserman, S. / Pattison, P. E. (1996), p. 301 f.
[36] See Wasserman, S. / Faust, K. (1994), p. 602.
[37] See Wasserman, S. / Pattison, P. E. (1996), p. 301 ff.
[38] See Wasserman, S. / Robins, G. (2005), p. 148 ff.
[39] Due to the complexity of the organizational structures and processes as well as their environmental relations the focus will be only on quoted corporations. However, it could be stated that quoted firms are in the focus of scientific disclosure within the research area of CG Questions pertaining to the area of CG could be raised, however, with all legal forms of an organization (See Feddersen, D. / Hommelhoff, P. / Schneider, U. H. (1996), p. 1).
[40] A full discussion of the selection criteria for companies and definition of interlocks included in the study are contained at the beginning of the respective country study. A detailed list of the constituents of the sub-samples included in the study and the raw network data are contained in the Appendix.

interlocking directorships and ownership is reasonable, since the web of institutional corporate ties has come under pressure in last years.[41]

Problems may result in the view of the separation between inter- and intra-organizational networks. Network structures do also exist in groups which consist of a multiplicity of single companies. However, for the purpose of this study relations that emerge between affiliated companies are not included. Exceptions to this restriction, if so, are marked separately in appropriate place in the respective country studies.

In general, the demarcation of a network which can be examined and the definition of a set of relevant enterprises are not unproblematic.[42] No clear criteria do exist to demarcate an individual governance system,[43] thus in this study we base our selection criteria on plausibility considerations to a large extent.

To ensure the accuracy of the network data only primary sources are employed.[44] As there is no reliable public database providing a good overview of shareholdings and holding mandates of managers, data were drawn from annual reports and from share registers.[45] Plausibility of the empirical results is given as key figures from previous network studies are considered.

1.3 Hypotheses, Structure and Methodology of the Empirical Analysis

1.3.1 Main Hypotheses[46]

The starting hypothesis is that IORs identified within the governance networks are not independent to each other. Theoretically, we argue that interaction in these networks can be illuminated by an approach based on the structuralist logic of sociological

[41] For example, in Germany, the system of personal relations has strengthened in last years while in the capital network evidence for a decartelization process has been proven (See Perlitz, M. / Becker, A. / Heubischl, J. (2004), p. 38).
[42] See Laumann, E. O. / Marsden, P. V. / Prensky, D. (1983), pp. 18-20; Thorelli, H. B. (1986), pp. 42-43.
[43] For further discussion see Windolf, P. / Beyer, J. (1995), p. 28 ff.
[44] Network researchers implicitly take reports by actors involved in a dyad to be more valid than those by third-party informants (see Marsden, P. V. (2005), p. 23).
[45] Newspaper coverage of information needed or public databases offered by private institutions is far from comprehensive and cannot be used for research purposes.
[46] For theoretical groundwork see Chapter 2.

network theory. Structuralist logic emphasizes how particular patterns of relationships - in this case, institutional interlocking triads - shape actors' roles and strategies. Triads create opportunities for constantly shifting alliances, as relations between any two actors are affected by appeals to the third. One assumes the goal of enterprises consists of optimizing their (triadic) structure of their respective set of relationships within the network. Typically, relational ties between pairs of actors are interdependent, given the interactive nature of the social processes that generate and sustain a social network. Evidence for these reciprocal effects could be found in the fact, that specific forms of the network structure which result from the composition of individual relationships could be proven more frequently within the networks than others. Reciprocal effects, therefore, can be regarded as typical for the network architecture.

The general hypothesis for this study is that within national governance networks evidence for interdependencies and reciprocal effects could be found that go beyond the dyadic level. Further hypotheses with regard to the logit of the governance structure that will be tested in the present country studies are:

Hypothesis 1: *Interlocking directorships and interlocking ownership are likely to show structural patterns of interdependence beyond the dyadic level.*

Hypothesis 2: *On the level of groups of participants the interdependence structures in the personal and capital relations exhibit any hierarchical character.*

In order to evaluate the expectations derived above, it is necessary to formulate a model that permits dependencies among network ties. Only with such a model is it possible to identify the specific forms of regularity in institutional interlocks.[47] These expectations are evaluated using the log-linear network model p* *(Frank / Strauss, 1986; Strauss / Ikeda, 1990; Wasserman / Pattison, 1996; Pattison / Wasserman, 1999; Anderson / Wasserman / Crouch, 1999; Wasserman / Robins, 2005)*, which takes into account that triads are not independent of each other, we examine the structural tendency to form particular network triad configurations of firms in the respective network economy. The p* class of models was developed specifically for the analysis of

[47] See Lazega, E. / Pattison, P. E. (1999), p. 76.

tie interdependencies and is used here to analyze interdependencies among interlocking directorates and ownership ties.[48]

From a theoretical perspective the number of hypotheses can be supported by simple plausible arguments:[49]

Since network governance needs to be achieved across the entire network we would expect the interdependence of corporate ties to take forms that are not simply dyadic but rather interlocking directorates and interlocking ownership are likely to show both dyadic and extra-dyadic patterns of interdependence (Hypothesis 1).

Since institutional interlocks are eventually hold for the purpose of the influence and control,[50] a hierarchical character might be supposed from the structural tendencies of enterprises in microstructure, understood as an actors' strategic embeddedness by the means of his individual arranged inter-firm relations (Hypothesis 2).

1.3.2 Structure of the Empirical Analysis

To focus on the analysis of the logic of network structures we first give a detailed description of today's economic network structures in the three European countries considered in this study from an inter-organizational perspective. The way of investigating interlocking corporate networks is the following: we analyse the structures of interlocking directorships and financial participation between the economies' largest enterprises forming the individual nation's corporate network. That is, two partial networks of corporate interlocks forming together the network economy are analysed. Network-analytic characteristic figures on the governance structure allow first conclusions regarding the systematic of the personal and capital network as well as for the total network of corporate relations. Particular consideration is given to the centrality of the network aiming for the most central actors within a network in an

[48] See Lazega, E. / Pattison, P. E. (1999), p. 76.
[49] For comprehensive readings see Chapter 2.
[50] See Franks, J. / Mayer, C. (1995), pp. 171-172; Heinze, T. (2001), p. 644.

attempt to account for their relative influence.[51] The descriptive results are compared to prior research findings, if available.

For a more comprehensive analysis further proceedings are necessary. Given the assumption of existent interdependencies between relations within the respective partial network this study investigates the logic of the relational system using the uni-variate p* model developed by *Wasserman / Pattison (1996)*.[52]

A discussion of the empirical results and finally a comparative view of allow specifying the differences that do exist between the different network economies, thus permits further interpretation.

1.3.3 Description of the Samples and Sub-samples: Composition and Size

Regarding the selection of the countries two criteria were considered: first, differences consisting in the social order of the market organisation,[53] and second, the fact of the existence of a deeply intertwined network of corporate relations. The latter criterion should guarantee that network-analytic studies already exist for the selected countries. This is to check network data and figures for plausibility and, moreover, to process these information for the formulation of hypotheses that are tested with the research model in this study. Moreover, these three economies differ with respect to their corporate legal structures,[54] considered to be a part of a broader view on CG.[55]

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[51] Centrality is one of the most important areas of investigation in substantive studies of social networks and widely used conceptual tools for analysing social networks. Nearly all empirical studies try to identify the most important actors within the network (see Everett, M. G. / Borgatti, S. P. (2005), p. 57). We look at a core-periphery approach to centrality, which identifies those sub-graphs that share common structural locations within networks.

[52] An extension of this model has been developed by Pattison / Wasserman in 1999 (see Pattison, P. / Wasserman, S. (1999)).

[53] Comparative analysis suggests some grouping at national level of the characteristics of CG systems. The different social market organisations are: Germany (corporatists' tradition), France (étatiste tradition) and the United Kingdom (market society). See Albert, M. (1991); Scott, K. (1997); Stokman, F. N. / Ziegler, R. / Scott, J. (1985); Brandeis, L. D. (1995). Some introductory overview of the main characteristics of each governance systems and its institutional environments is provided at the beginning of each country study.

[54] The corporate legal structure rules the interrelationship between a company and its environment. This contains the distribution of tasks, responsibility, and competencies among the top management of a company. It is mainly concerned with corporate circumstances. From that point of view, it is a part of the broader view on Corporate Governance that covers market-related subjects as well (see Bleicher, K. / Leberl, D. / Paul, H. (1989), p. 35).

[55] The different legal frameworks in organisations in Germany, United Kingdom and France are not explicitly described in this study as they are expected to be well-known. However, to follow the definitions of the individual delineation of unit of analysis for each country study, respective knowledge is essential.

We selected the major network economies, namely Germany, France and the United Kingdom, three major economies with relationship investing. This should allow us to demonstrate an analysis on the systematic of the network structure in a more distinct way. With respect to each economy, we selected the largest corporations listed at the respective stock and grouped in some indices, thus following a positional approach *(Laumann / Marsden / Prensky, 1989)* in setting network boundaries.[56] A target on different number of enterprises in the sample was adopted partly for purpose of delineation and partly because of practical limitations on the number of companies which could realistically be handled in the time allowed and data available. The idea in setting the particular criteria was to provide a representative sample on the whole economy respectively. However, it should be noted that any study which selects a subset of corporations for investigation is likely to involve cases where interlocks between selected corporations arise from links to a company outside this set of actors.

In Germany we chose enterprises listed in the Prime All Share-Index and for the United Kingdom the FTSE-350 constituents were selected. In France we opted on companies listed in the SBF250 index. This selection should give a broad reflection of the corporate landscape in the respective economies comprising the largest stock-listed companies. A detailed description of the samples and sub-samples are given in the individual country studies.

1.4 Delimitations of the Study

A sound sociological research work comprising not only a comprehensive and detailed description of the research conducted and the reasoning of the research strategy and structure but rather the presentation and critical discussion of the assumptions and restrictions made. Given this fact, this section is dedicated to discuss some of the major

[56] Deciding on the set(s) of objects that lie within a network is a difficult problem for whole-network studies. Laumann / Marsden / Prensky (1989) outlined three generic boundary specification strategies: a positional approach based on characteristics of objects to formal membership criteria, an event-based approach resting on participation in some class of activities, and a relational approach based on social connectedness. For more see Laumann, E. O. / Marsden, P. V. / Prensky, D. (1989), pp. 61-87.

delimitations of this study. This allows the Reader to adequately evaluate the research results in this field.

Empirical research studies require a great deal of work. Significant efforts must be made to collect and codify pertinent corporate network data base. Furthermore, to allow for valid comparisons, the coding and measurement operations in each country must be coordinated and adjustments made to control for systematic measurement biases and ensure conceptual equivalence (e.g. identical network measures must be taken for each country allowing for direct comparisons of network structures while minimizing systematic measurement errors). When drawing conclusion upon the empirical results the social and institutional context of the particular economies must be taken into account.

Delimitations of the study could be mainly found in the selection of the sample criteria as well as some weaknesses in the research model. However, the results of the study should not be considered to be a representative sample; they give at least a tentative answer to the question of a systematic underlying structural logic of the governance networks examined.[57]

The first restriction results from the assumptions and definitions made regarding the data selection process: boundaries of the networks built from the relations of a set of connected agents are confined by the particular sample of firms (reputational approach).[58] Of course, there may be no real "boundary" to a network,[59] but the practicalities of conducting an empirical research investigation often require that some such decision be taken, at least implicitly.[60] Thus, in fact, this an imperfect representation of the full network as connections outside this locale are ignored. However, the dataset comprising the largest stock-listed business corporations of the

[57] For implications of the study and for further research see Chapter 5.2.
[58] Researchers have to decide on some putative "boundary" to the network in advance of the survey (see Laumann E. O. / Marsden, P. V. / Prensky, D. (1989), p. 61 f).
[59] For example, White, H. C. (1992).
[60] The problem of boundary specification in network studies is widely recognised and various approaches have been suggested. See, for example, Laumann, E. O. / Marsden, P. V. / Prensky, D. (1989). Marsden, P. V. (2005) shows how recent developments have moved beyond the conventional, and often inadequate, approaches to boundary setting.

particular country in terms of market capitalisation, hereby representing nearly a full picture of the corporate landscape.

Secondly, the selection and narrow definitions set for the data collected regarding the two types of institutional interlocks do not reflect the full extent of the web of interweaving relations prevalent in the respective governance networks. However, the definitions in the respective country studies have been set under consideration of the governance perspective in order to attain useful network data for further interpretation.

Thirdly, using logit models offers a number of delimitations with regard to parameter estimation procedure.[61] Moreover, recent studies have shown that besides dyadic and triadic network configurations likewise multiple network configurations reveal valuable information.

The main statistical focus in literature is on probabilistic network models for single (or uni-variate), dichotomous, directed relations.[62] Firstly, this entails an information loss regarding valued network data relating to statements about network configurations. Furthermore, in addition, interdependences can be assumed between various types of relationships; therefore, a bi-variate or multi-variate analysis might reveal useful information investigating the structural logic of the relationship structure.

Finally, the general statement should be made that due to the numerous publications on this subject-matter, in particular in recent years, it is utterly impossible to incorporate all thoughts in our considerations; moreover, we are restricted by the extent of the paper. However, it is not the purpose of the authors to comment on all the issues raised; instead this paper rather pays attention to one specific issue regarding the governance systematic in European corporate interlock networks.

1.5 Organization of the Study

The book is organized as follows:

[61] See Anderson, C. J. / Wasserman, S. / Crouch, B. (1999); Wasserman, S. / Pattison, P. (1996).
[62] See Anderson, C. J. / Wasserman, S. / Crouch, B. (1999), p. 43.

The work is mainly divided into two separate parts: a theoretical (conceptual) level (**Chapter 2**) and an empirical level (**Chapter 3 and 4**).

In **Chapter 2** the theoretical and basic conceptual knowledge is discussed as well as basic definitions are presented establishing the scientific context in the research field of this study in order to prepare and advance the Reader to better understand the empirical part of the work following. However, the aim is not to present a scientific treatise but rather to provide the Reader specific theoretical knowledge pertaining to this study in order to bring along a better understanding for the research questions raised. Thus, no requirement on complete consideration of all aspects in these two chapters is given.[63] The chapter starts with a common definition of corporate networks for the purpose of this study. Moreover, the network phenomenon is introduced and arguments on the relevance of governance networks and corporate ties linking corporate actors in general are provided. Those networks usually emanate from top management decisions and are based on a top management (e.g. interlocking directorships) or capital level (e.g. shareholdings, financial interlocking). This lays the groundwork for a better understanding of how corporate networks are built up. A transition to the exploratory study in Part II is made, with a theoretical discussion of structural components within a social network.

In **Chapter 3** terms and definitions are introduced used in the following empirical analysis, and the research model used to analyze the structural logic of the corporate networks to identify specific regularities and tendencies in local microstructure is described. **Chapter 4** is partitioned into four sub-sections. After a brief introduction to the empirical study that is conducted (**Chapter 4.1**) three separate network studies are presented: Germany (**Chapter 4.2**), France (**Chapter 4.3**) and the United Kingdom (**Chapter 4.4**). All country studies are structured in the same way: firstly the social structure of the prevalent governance networks is analysed and an empirical mapping of patterns of social relations between large enterprises in these network economies is presented based on empirical data. In the following the empirical results of the uni-variate analysis on the empirical data are discussed given the number of hypotheses

[63] At respective spots in the text a number of reference works is given the Reader could draw on in order to deepen his knowledge on the marked out issues.

addressed to the Reader at the very beginning of each country study. In closing, we briefly discuss the main contributions and limitations of the study; we critically discuss the empirical findings, and provide implications for further research (**Chapter 5**).

2 GOVERNANCE NETWORK SYSTEMATIC AND COOPTATION STRATEGY

2.1 Conceptual Principles on Social Networks and Interlocks

Social networks and interlocks are, strictly speaking, not a new phenomenon. Organizations dominate our socioeconomic landscape, they are fundamentally relational entities.[64] The focus on relations leads naturally to representation and analysis of organizations as social networks. *Nohria (1992)* asserts that "all organizations are in important respects social networks and need to be addressed and analyzed as such".[65] Moreover, *Nohria (1992)* notes different levels of foci: "The premise that organizations are networks of recurring relationships applies to organization at any level of analysis – small and large groups, subunits of organizations, entire organizations, regions, industries, national economies, and even the organization of the world system".[66] Inter-organizational networks are a venerable subject in sociology and organizational theory.[67] The concept of the "network" has become even more popular, as management consultants and organizational theorists promote the "network" as the inter-organizational form of the future.[68]

The study of inter-organizational relationships (IOR) has begun to suffer the consequences of its own growth in importance. The increasing acknowledgement that organizations typically operate in a relational context of environmental interconnectedness and that an organization's survival and performance often depend critically upon its linkages to other organizations has generated a vast but highly fragmented literature on IORs.[69] Many types of IORs have been studied in a variety of settings, a suggestion for integrating this literature into generalizable predictors of relationship formation, i.e. to distinguish between what causes such relationships or the

[64] See O'Reilly, C. A. (1991), p. 446.
[65] See Nohria, N. (1992), p. 4.
[66] See Nohria, N. (1992), p. 4.
[67] See Baker, W. E. / Faulkner, R. R. (2002), p. 520.
[68] See Powell, W. W. (1987), p. 67 ff; Powell, W. W. / Smith-Doerr, L. (1994), p. 368 ff.
[69] See Oliver, C. (1990), p. 241.

conditions under which such relationships occur has been made *Oliver (1990)*; this generability moves the field of IOR research toward a general theory of relationship formation that is applicable across a variety of IOR types and settings.

In organization science the study of networks has a long history. Like the institutional perspective, the network perspective is phenomenological, in the sense that it focuses on the content of networks of interpersonal and inter-organizational relations and the meaning of action as defined by the network.[70] Sociological network theory[71] builds closely on the concern with how social milieu produces social identity and, in doing so, shapes the actions of individuals, not merely in the negative sense, but in the positive sense of establishing accepted, rational forms of action.[72] Over time, the network concept has evolved from a metaphor for "informal structure" to a formal research tool (*White / Boorman / Breiger, 1976*) lending itself to quantitative analysis, thus become a valuable and flexible device for characterising and analysing the actual interconnectedness among organisations.[73] A shift in levels of analysis from a focus on patterns of relations among people within organizations to focus on how organizational environments are constituted has evolved; this shift in level was sparked in part by *White's (1981)* pioneering "sociology of markets", which became a call to action to network theorists in sociology. *White's (1981)* work was reinforced by *Granovetter's (1985)* revival of *Polanyi's (1944, 1957)* concept of "embeddedness", the notion that organisations and the economy are part of a larger institutional and inter-organizational structures, and that the context of organizational action shapes rational choice in market situations.[74] Building on the basic insight that much of organizational behaviour takes place within dense networks of ties among organisations, research has made great headway, particularly over the last decade, in explaining how the structural and

[70] See Baum, J. A. C. / Rowley, T. J. (2002), p. 13.
[71] Sociological network theory is a discipline that has its roots in the mathematical analysis of graphs.
[72] See Baum, J. A. C. / Rowley, T. J. (2002), p. 13.
[73] See Baum, J. A. C. / Rowley, T. J. (2002), p. 13.
[74] The theoretical proposition encapsulated in the term "embeddedness" has captured inter-organizational researchers since the early economic anthropologist Polanyi (1957) described the extent to which economic institutions are embedded in political and social institutions. But it was Granovetter's (1985) theoretical development of the idea that vivified research on inter-organizational relationships. For example, Uzzi (1996, 1997, 1999) has produced a stream of research documenting and specifying the effects of social structure on economic transaction; his structural foci are on the dyad and the organization set.

informational properties of networks and network positions can predict organizational behaviour.[75]

But first things first: Despite the popularity of networks in research as well as in practice, the knowledge, however, is still limited regarding this phenomenon.[76] Neither a uniform understanding for the term exists, nor does agreement exist over the actual use, the advantages and the success-critical factors of networks. However, little knowledge still exists with regard to efficient co-operation and co-ordination structures as well as the relation between different networks to each other. Substantial research is needed regarding the analysis of effects of interlocks on power and decision structures in organizations. Moreover, a review of the social network literature reveals that much of the network analysis has appeared in studies of individual participation and relied on an ego-centric perspective[77]; networks are rarely investigated in a holistic perspective.

Within the research field focusing on networks a number of definitions of the term as well as surveys regarding various network types can be found in literature. Moreover numerous approaches to explain their existence are researched. In particular, the work of *Grandori (1999)*, *Picot / Reichwald / Wigand (1996)*, *Sydow (1999)* and *Gulati / Nohria / Zaheer (2000)* provide a comprehensive overview regarding these aspects. Moreover, extensive discussions regarding the reasoning as well as the pros and cons of network co-operation is elaborated. The theoretical focus ranging from institutional economics (e.g. *Picot / Reichwald / Wigand, 1996*) and social network perspective (*Gulati / Nohria / Zaheer, 2000*) to aspects of the development of a self-established network theory (*Fleisch, 2001*).

Social networks are not homogeneous constructions; in fact, under the term a multiplicity of different forms and developments of inter-organizational co-operation is summarized. Thus, if the focus is on networks, usually one uses a simplifying model reducing the complexity of these systems in reality. However, despite the popularity of networks - in different field of studies the phenomenon has been investigated employing

[75] See Baum, J. A. C. / Rowley, T. J. (2002), p. 13.
[76] See Sydow, J. (1999), p. 304.
[77] The ego-centric perspective takes the individual as the unit of analysis.

a different perspective[78] - a clear conceptual demarcation of the term in academic literature is missing.[79] Most generally speaking, a social network is a map of the relationships between social actors.[80] If a connection between at least two legally independent enterprises is present, one can assume that this construction already forms an inter-organizational network.[81] More generally, *Uzzi (1996)* refers to networks as "composed of finite, close-knit groups of firms, a set of firms that maintain ongoing and exclusive relationships with one another".[82] Another basic definition of the term is given by *Nohria / Eccles (1992)*: "[…] the structure of ties among the actors in a social system. These actors may be roles, individual persons, organizations, industries or even nation states. Their ties may be based on conversation, affection, friendship, kinship, authority, economic exchange, information exchange, or anything else that forms the basis of a relation."[83] *Grandori (1999)*: "An inter-firm network will be conceived and defined as a set of firms, generally characterised by different preferences and resources, coordinated through a mix of mechanism not limited to price, exit and background regulation."[84]

Following the number of definitions presented the concept of "relation(ship)" is essential for organizational network forms. According to *Hakansson / Snehota (1995)* a relation is the "[…] mutually oriented interaction between two reciprocally committed parties".[85] For the purpose of this work the understanding of networks is based on the social network perspective which has found a broad acceptance and use in social science. Here, networks are defined by social relations comprising the exchange not only of goods and services but also of influence and power as well as of information between definite groups of finite actors.[86] A number of different types of actors can be analysed, however, organisations, and firms in particular, are of particular interest of

[78] For comprehensive reading on different network approaches and perspectives in research see Renz, T. (1998), pp. 103-263.
[79] See Windeler, A. (2001), p. 16.
[80] The term was first coined in 1954 by Barnes (1954).
[81] See Snow, C. C. et al. (1992), p. 13ff; Thorelli, H. B. (1986), p. 37 ff; Staber, U. (2000), p. 58.
[82] Uzzi, B. (1996), p. 676.
[83] Nohria, N. / Eccles, R. G. (1992), p. 288.
[84] See Grandori, A. (1999), p. 2.
[85] Hakansson, H. / Snehota, I. (1995), p. 25.
[86] See Tichy, N. / Tushman, M. L. / Fombrun, C. (1979), p. 507 ff; Koza, M. P. / Lewin, A. Y. (1999), p. 638; Sydow, J. (1992), p. 78.

academics.[87] In literature the term inter-organizational networks is widely used,[88] which can be defined from economical view as "polycentric forms of organisations of at least three legally independent entities […] between which complex cooperative and relatively stable relations exist."[89] Individuals play an important role in inter-organizational networks, particularly with regard to inter-personal networks, which have often been object of analysis in empirical research.

According to *Sydow (1999)* the common understanding of inter-organizational networks is social networks where actors are organisations.[90] Those networks are complex social webs established on the basis of strategic.[91] For the purpose of this study inter-organizational networks and corporate networks are used as synonyms. In fact, in sociology a number of different types of inter-organizational networks are existent. Interlocks within corporate networks can be differentiated according to their type (e.g. interlocking directorates, capital ownership, financial ties, credit or supplier relation-ships etc.) and structure.[92] However, it can be assumed that in general cooptation and co-operation is economically motivated. Institutional linkages between organisations, in particular, aim for increasing stability of existing co-operation and potential influence on strategic decisions of the partner. Here, one can differentiate between personal linkages and ownership ties.

Today, there is a growing recognition about the importance of different corporate ties, regarding the relative importance of interlocks as a governance mechanism and the necessity to adapt to dynamically changing inter-organizational networks to hold on to the process of global competition. The field of research on inter-organizational networks hereby draws from a divers array of theories and spans levels of analysis from microstructures (*Laumann / Marsden, 1982*) to the entire economy (*Burt, 1992*). Within

[87] For a list of parties that can be linked to each see Nohria, N. / Ecccles, R. G. (1992), p. 288 f; Tichy, N. / Tushman, M. L. / Fombrun, C. (1979), p. 507.

[88] Inter-organizational networks are in the focus of research in organizational and political discipline. In management discipline a particular focus is on strategic alliances and networks. In the political science the common understanding is the cooperation of numerous governmental institutions, private organisations and corporative actors beyond any hierarchical order and sectoral or national classification (see Hild, P. (1997), p. 88).

[89] Following Sydow's (1992) definition of corporate networks, which he considers as particular form inter-organizational networks (see Sydow, J. (1992), pp. 78-80).

[90] An overview of network typology is found in Sydow, J. (1999), pp. 284 ff.

[91] See Kappelhoff, P. (2000), p. 31.

[92] See Ibarra, H. (1993), p. 471 ff; Brass, D. J. / Butterfield, K. D. / Skaggs, B. C. (1998), p. 14 ff.

the domain, interlock research[93] has exercised a peculiar fascination especially for social researchers and has become a legitimate and respectable area of scientific specialization. The examination of these complex systems of interlocking corporate actors has been in the focus of researchers for a long time. It has employed economists, lawyers, political scientists, and sociologists equally. Some of the most influential researchers in early research are, among others, *Pennings (1980)* and *Mintz / Schwartz (1985)*.

The research on corporate networks deals inter alia with questions such as what are the central connecting factors of inter-company networks, how do corporate networks change over time and why, do network structures differ between Corporate Governance systems, are (global) business elites established through network structures, do corporate networks assist or impede economic performance, are (global) business elites established through network structures, and how does interlocking affect a company's behaviour. Nevertheless, it is a discussion about concentration of power and control, thus extremely relevant in business research.[94] Sociological research, in particular, aimed to detect a relationship between the network of interlock ties and the social and influential power and control of corporates. They believe that interlock ties enhance the social cohesion of classes and allow to define and to promote common class interests.[95]

Among the broad research within this academic field, scientists dealt with the distribution and concentration of (economic) power and control in networks in numerous countries.[96] From an inter-organizational perspective, within the system of corporate governance, companies exert mutual control, for example, by the delegation of managers to the top management of other companies as well as by capital ownership. However, scientific research not only concerns with dyadic relations between particular enterprises, but also with the global features of network structure and governance

[93] An interlock is simply the social relation that is created between two enterprises.
[94] For comprehensive understanding of business research see Zikmund, W. G. (2003), pp. 2-19.
[95] Class theorists stress the fact that corporations are not independent entities with lives of their own, but are instead tools of class domination and capital accumulation (see Mizruchi, M. S. (1987), p. 206). Social and class relations have to be studies in trying to understand corporate behaviour (see Mizruchi, M. S. / Schwartz, M. (1987), p. 9).
[96] Corporate interlock networks as part of a nation's market institution are a powerful instrument (see Stokman, F. N. / Ziegler, R. / Scott, J. (1985), p. 20).

systematic. *Domhoff (1980)* has introduced the term 'power structure' research. It is held that the features of the inter-corporate network play an important and generally unrecognized role in the structuring of economic power and in wider social processes.[97] However, the study of economic power is not a unified area of research, but has involved a number of competing perspectives and theoretical models. Concern over the problem of economic power had an important point of origin in the work of *Karl Marx*, and the subsequent development of Marxist theory has criticized much of the academic work in the area. Contemporary research in this main stream concerning the exercise of power between organizations has its origins in political economy (*Zald, 1970*), exchange (*Emerson, 1962; Thompson, 1967*), strategic contingency (*Hickson et al, 1971*), resource dependence (*Pfeffer / Salancik, 1978*), and network (*Burt, 1980*) theories of power and dependence.[98] The increased sophistication of interlock research has been a willingness to break with political dogma in an attempt to grasp the real significance of the phenomena under investigation.[99]

The study of inter-organizational network relationship brought together sociologists, economists, and political scientists facing research questions of industrial organization. Interlocks may be regarded as signs of possible power relations ('power structure' research (*Domhoff, 1980*). An analysis of the governance network, both its structure and if identifiable any systematic demonstrates the distribution of economic power[100] in the national corporate landscape[101] and demonstrates the distributional structure of social capital[102].[103] Accordingly, the architecture of social networks is important because it shapes organizational behaviour; changes in the structure of the network should have

[97] Scott, J. (1985), p. 2.

[98] Power struggles for control between organizations, for example: financial corporations use their economic leverage to coerce desired behaviour from non-financial firms (see Mintz, B. / Schwartz, M. (1985)).

[99] Scott, J. (1985), p. 3

[100] On an inter-organizational perspective, relations between enterprises are seen as constitutive of the environment within which they are located and therefore as determinants of their possibilities of action (for different perspectives on economic power see Stokman, F. N. / Ziegler, R. / Scott, J. (1985), pp. 3-5).

[101] Interlock research allows easily drawn conclusions about the concentration of (economic) power within the particular corporate landscape.

[102] Comprehensive literature is available on this subject, e.g. Burt, R. S. (2000).

[103] In the sense of the potential to mobilize the resources of another person in order to pursue one's own interest.

important consequences for the strategies adopted by organizations.[104] However, networks among financial, commercial, and industrial firms determine significant features of that economy's overall organization and its resulting performance.[105]

Studies on economic power have involved a differentiation of focus along two main dimensions: the unit of analysis see as either enterprises or persons and the level of analysis seen as either the level of agent or the level of the system. A cross-classification of these two dimensions generates the four major perspectives on economic power.[106] Those four perspectives have structured much of the research on economic power. For the analysis of the governance structure and its systematic, described in the following, the focus will be on the inter-organizational perspective. On an inter-organizational perspective, relations between organizations are seen as constitutive of the environment within which they are located and therefore as determinants of their possibilities of action.[107]

Key studies of inter-organizational networks, organized according to units of analysis are seen in the work of *Eccles / White (1988)*, *Larson (1992)*, and *Zuckerman (1999)* with respect to dyads; *Davis (1979)*, *Gargiulo (1992)*, *Baker / Obstfeld (1999)*, and *Della Porta / Vannucci (1999)* for triads; *Evan (1966)*, *Baker (1990)*, *Baker / Faulkner / Fisher (1998)*, *Baker / Faulkner (1993)*, and *Uzzi (1999)* within the domain of organization set; and within the organization field works of *DiMaggio / Powell (1983)*, *Laumann / Knoke (1987)*, *Powell / Koput / Smith-Doerr (1996)*, *Suchman (1998)*, and *Scott et al. (2000)*.[108]

In the following a particular focus is put on two particular types of IORs: interlocking directorates and interlocking ownership.

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[104] See Davis, G. F. / Yoo, M. / Baker, E. W. (2003), p. 302.
[105] See Gerlach, M. L. / Lincoln, J. R. (1992), p. 491.
[106] Organizational perspective (agent / enterprise); social-background perspective (agent / person); class-hegemony perspective (system / person); inter-organizational perspective (system / enterprise).For more see Scott, J. (1985), p. 9 f.
[107] For different perspectives on economic power see Stokman, F. N. / Ziegler, R. / Scott, J. (1985), pp. 3-5.
[108] For more on structuring the field of inter-organizational networks see Baker, W. E. / Faulkner, R. R. (2002), p. 521 ff.

The most extensive definition of the term interlocking directorships which has been applied by some of the most influential researchers in this field[109] is the following: an interlocking directorship occurs whenever one individual is simultaneously a member of the board and / or the top management team of more than one company. In literature, the term interlocking directorship has been often criticised because it automatically suggests a link between two firms whenever they share a director, thus is a very broadly defined term. That is why some authors have used other terms, for example, outside directorships *(Kaplan / Reishus, 1990)*, director networks *(O'Neal / Thomas, 1995; Geletkanycz / Boyd / Finkelstein, 2001)*, multiple board directorships *(Conyon / Bryant, 1998)*, board overlap *(Loderer / Peyer, 2001)* or outside director appointments *(Carpenter/Westphal, 2001)*.

Interlocking directorates could be differentiated according three major dimensions: directionality, interlock intensity and structural type of the relationship. The first differentiation of interlock ties categorizes directional and non-directional ties. A situation where the shared individual has a stronger affiliation with one of the two firms is called directional tie. This is the case whenever an executive director is sent onto the top management of one company holding an outside (supervisory) board mandate. A non-directional tie is created when the interlocked manager holds non-executive (supervisory) mandates in two companies. This relationship could hardly be interpreted as an asymmetric power relationship, as the mandate holder is not associated with either the one or the other firm, thus is less influential than directional ties.

Secondly, the intensity or strength of a relational tie could be measured. In the case of interlocking directorships the number of mandates hold by one firm onto the top management of another firm indicates inter-organizational purpose. It could be assumed that the higher the number of directors two companies share the tighter the relationship might be. Given this assumption one must consider the size of the board of a company, *Berkowitz et al. (1979)* and also *Pennings (1980)* have proposed that the number of shared directors should be normalised by board size.[110]

[109] For example: Allen, M. P. (1978), Pennings, J. M. (1980), Useem, M. (1984), Pettigrew, A. (1992), Mizruchi, M. S. (1996), Scott, J. (1997).
[110] See Berkowitz, S. D. et al. (1978), p. 49 f; Pennings, J. M. (1980), p. 38.

A third dimension differentiates interlocking ties into horizontal ties and vertical ties: A vertical tie could be understood as an inter-corporate business relation between two parties at different levels of the value chain, for example, an interlock tie between a firm and its supplier or its customer or so-called bank interlocks[111]. On the contrary, ties among competing firms are called horizontal interlocks. In this context, interlock research has focused on two issues: first, to which extent firms are interlocked with their competitors, and secondly, analysis of intra-industry interlock concentration. Interestingly, today more and more competitors are linked by interlocking directorates with each other, particular with the rise of multi-business firms. In consequence, it has become more difficult to establish whether two companies are direct competitors.

One could combine the dimensions; consequently, this allows a greater range for interpretation. For example, it is wise to weight interlock intensity by directionality.[112] To give an example: if a company sends several of its executives to the top management of another company, it becomes obvious that the sender organisation holds control over the dependent firm using interlocking directorships as its device. An equal ratio of directional ties regarding two parties (reciprocal interlocks) suggests two partners are equally strong.

A controversial issue in interlock research are so-called indirect interlocking directorates, sometimes referred to as "weak ties". These occur when directors of two companies sit together on the same governance organs of a third party. *Pennings (1980)* claims that indirect interlocks have minimal relevance for IORs because the firm's benefit decreases with the number of intermediaries and because such interlocks are only one among several potential accesses between two companies.[113] On the contrary, *Granovetter (1973)* argues that such weak ties serve as bridges between clusters and as such are important sources of new information or accelerate the diffusion of innovations.[114] Another type of interlock directorship that could be found in literature are neutral ties defined as those between two firms that have no other business or ownership relations with each other. *Pennings (1980)* speculated about neutral ties to be

[111] Interlocks between banks or other financial institutions and non-financial organisations. For more research on bank interlocks see among others Mizruchi (1996) and Nollert (1998).
[112] See Fennema, M. / Schijf, H. (1978), p. 323; Faris, R. M. (1991), p. 57.
[113] See Pennings, J. M. (1980), p. 38.
[114] See Granovetter, M. (1973), p. 1363 ff.

less relevant for inter-organizational coordination and could be only beneficial to the diffusion of innovations or simply work as information and communication channels.[115]

One could assume that the more higher the number of corporate interlock associated with an organisation, the stronger the social embeddedness (*Granovetter, 1985*) within a larger network might be. But, it is important to understand that structural embeddedness focuses on the relational quality of inter-actor exchanges and the architecture of network ties. However, social embeddedness has become a performance variable. Results reveal that firms organized in networks have higher survival chances;[116] more than one network mechanism can be cited as responsible for competitive advantage, also known as social capital.[117]

Interlocking directorships can coincide with share ownership or financial participation, the second type of institutional interlocks. A company that has a large stake in another company is strongly interested to participate directly in the decision-making process and to supervise the management. Depending on the size of share ownership the company might have the voting power to elect one of its executives or another representative to the board of the other company. Consequently, an interlock tie which coincides with ownership or financial participation primarily serves a control function.

Since interlocking directorates and cross-shareholdings represent the only types of interlocks, for which systematic data is available, these two types of corporate relations are in the focus of the empirical studies in Part II. Other types of relations between corporate organisations, that might be more important from an economic view,[118] will be neglected.

2.2 Motives and Cooptation Strategies in Social Networks

Organizations consciously enter into relations from an organizational (top-management) perspective for specific reasons within the constraints of a variety of

[115] See Pennings, J. M. (1980), p. 39; see also Berkowitz, S. D. et al. (1978), p. 396.
[116] See Burt, S. R. (2000), p. 345 ff. According to Burt (2000) social capital is a metaphor for the accumulated wealth built up in a personal network (see Burt, S. R. (2000), p. 346 ff.
[117] See Uzzi, B. (1996), p. 675 ff.
[118] See above.

conditions that limit or influence their choices.[119] In general, enterprises aim for relational benefits, particularly for options how to act; one way might be to achieve this is to interact with other organizations. In the context of the structure organization they aim for collective strategies together with other participants. However, it can be assumed, that actors deliberately enter into networks within the context of their "interactive and institutional policy" *(Elsner, 2003)*.[120]

Based on an integration of the IOR literature from 1960 on, six critical contingencies of relationship formation can be outlined as generalized determinants of IORs across organizations, settings and linkages: necessity, asymmetry, reciprocity, efficiency, stability, and legitimacy.[121] These contingencies are causes of relationship formation, although they may interact or occur concurrently, i.e. inter-firm formation decision is commonly based on multiple contingencies.[122]

An organization often establishes inter-firm linkages in order to meet necessary legal or regulatory requirements,[123] e.g. mandated corporate structures of coordination (*Whetten, 1981*). The contingency of asymmetry refers to IORs prompted by the potential to exercise power, influence or control over another organization or its resources.[124] The contention that organizational efforts to control interdependencies predict relationship formation also is fortified by the assumption that relationship formation necessitates the loss of decision-making latitude and discretion.[125] Theories of political economy (*Benson, 1975; Zeitz, 1980*), resource dependence (*Pfeffer / Salancik, 1978*), class hegemony and elitism (*Useem, 1979; Palmer 1983*), and financial control (*Fitch / Oppenheimer, 1970; Kotz, 1978*) attribute motives of power and control to the establishment of IORs. In contrast to the contingency of asymmetry in IORs, a considerable proportion of literature implicitly or explicitly assumes relationship

[119] See Oliver, C. (1990), p. 242.
[120] See Elsner, W. (2003), p. 27.
[121] According to Oliver (1990).
[122] For more see Oliver, C. (1990), pp. 246-248.
[123] Warren (1967); Stern (1979); Provan / Beyer / Kruytbosch (1982); Leblebici / Salancik (1982); Provan (1983).
[124] Blau (1964); Evan (1966); Aiken / Hage (1968); Benson (1975); Paulson (1976); Molnar (1978); Pfeffer / Salancik (1978); Whetten (1981); Boje / Whetten (1981).
[125] Thompson / McEwen (1958); Evan (1966); Thompson (1967); Rogers (1974); Cook (1977); Whetten (1977); Aldrich (1979); Whetten / Leung (1979); Schermerhorn (1981); Provan (1982, 1983); Fenell / Ross / Warnecke (1987).

formation to be based on motives of reciprocity, such as cooperation and collaboration rather than domination, power and control, e.g. *Pfeffer / Nowack (1976)*. The reciprocity model of IORs is theoretically rooted in exchange theory (*Emerson, 1962*) and is also consistent with the financial capital theory of inter-corporate relations (e.g., *Harvey, 1982; Scott, 1985*), the reciprocity model of director interlocks (*Dooley, 1969; Allen, 1974; Koenig / Gogel / Sonquist, 1979*), and the collective strategy framework (*Astley / Fombrun, 1983; Astley, 1984; Oliver, 1988*). The analysis of corporate networks - as systems of social reciprocity *(Kappelhoff, 2000)* - has gained increased intention from the beginning of the 90s;[126] however, concurrently criticism has appeared.[127] *Williamson's (1975, 1985)* transaction cost perspective is consistent with the argument that efficiency is an underlying determinant of IORs. This framework predicts that transaction cost economization determines whether transactions will be carried out within organizations, in intermediate structures (IORs), or in the market. Another contingency of relationship formation is stability: IORs serve as coping strategies for environmental uncertainty reduction.[128] The enhancement of organizational legitimacy also has been cited as a significant motive in the decision for relationship formation. Institutional theory (e.g., *DiMaggio / Powell, 1983; DiMaggio, 1988*) suggests that institutional environments impose pressures on organizations to justify their activities; these pressures motivate to increase legitimacy.

With regard to institutional relationships, particularly interlocking directorates and ownership ties, the following can be stated:

The sharing of corporate leaders among firms potentially serves various purposes. Potential motives have been analysed on three different levels: the societal, the corporate and the individual level. Academics generally identify four models of interlocking directorship: The *resource dependency model* says that firms cooperate on matters of mutual interests with interlocking of directorates being one of the ways in which this dependence on resources and cooperation is brought about. In contrast, the

[126] See Kappelhoff, P. (2000), p. 26.
[127] Strategic interests of the actor with regard to network structure is often neglected (see Stinchcombe, A. (1990), p. 381).
[128] Thompson (1967); Starbuck (1976); Cook (1977); Pfeffer / Salancik (1978); Aldrich (1979); Pennings (1981); Schoorman / Bazerman / Atkin (1981); Williamson (1985).

management control model downplays the role of board interlocks and emphasizes that managers take the most important decisions and as such, are unaffected by the opinions of the board. The proponents of the *finance control model* postulate that firms depend on a dense network of inter-corporate ties, especially with financial institutions, as they are the principal providers of finance. And finally, the *class hegemony model* proposes that interlocking directorships ensure the appointment of candidates with similar backgrounds, characteristics and political beliefs from within the personal networks of incumbent board members. This elite class of directors serve to protect the class welfare and that of individuals who belong to the class.

From a theoretical perspective directional ties of directorship are important to the sending organisation for at least four reasons. First, the major interests of the manager sent to another firm are tied to the sender organisation.[129] Second, the executive of the sender organisation receives intimate and first-hand information about the other company. Third, a directional interlock is often taken as an indicator for an asymmetric power relation between two companies in which the receiving organisation is dependent upon the sending firm.[130] And fourth, firms may encourage their executives to accept outside directorships as a sort of management development. This aims to strengthen the executives' sensitivity to the company's business environment[131] On the other hand the receiving company is autonomous in nominating a new director. Consequently, it can be assumed that there are sound and objective reasons for the election of another company's Executive.

Deliberately opting for interlocking directorships has its aim in a particular cooptation strategy of the respective actor: above all, they aim for reduction of environmental uncertainties[132], maintenance of a certain degree of power as well as to increase social cohesion[133] Moreover, such inter-corporate ties are often said to lower transaction costs[134] and to foster the dissemination of information. On the top of that, they force

[129] See Fennema, M. /Schijf, H. (1978), p. 297; Pfannenschmidt, A. (1995), p. 198.
[130] See Faris, R. M. (1991), p. 57.
[131] See Useem, M. (1984), p. 48.
[132] See Schreyögg, G. / Papenheim-Tockhorn, H. (1994), p. 382; Schreyögg, G. / Papenheim-Tockhorn, H. (1995), p. 207.
[133] See Windolf, P. / Beyer, J. (1995), p. 16 f.
[134] For the transaction-cost approach see Pfannschmidt, A. (1995), p. 178.

managers to coordinate their decisions with external constituencies and therefore, they might also serve as a control function.[135] On the other hand, at least some of these interlock ties contradict the strive for more director independence and higher transparency for shareholders. By the means of interlocks an actor receives power and influence over others. Directorships can be seen just a resource of power like ownership.[136] Conflict of interests may arise whenever you have two managers sitting in at least to boards.[137]

Looking at cross-shareholdings[138] it can be affirmed that these interlocks play a particular role in markets: they can be understood as a potential source for inter-corporate power and coordination leading to corporate control; one example is might be the bank hegemony in Germany.[139] Moreover, ownership structure is an important means for governance. Likewise for interlocking directorships, share ownership may provide influence and control over a third party.[140] Generally, one can assume a higher ownership stake to come along with more influence on the management of the respective entity.[141] It follows, that the more dispersed share ownership of one company is, the more independently the management may govern the organisation.

2.3 Network Governance

Corporate networks come along with some network governance[142], characterised by formal structural components and multi-directional relations, i.e. a complex relational systematic. *Uzzi (1996)* argues that ongoing social ties shape actors' expectations and opportunities in ways that differ from the economic logic of market behaviour.[143] But why do firms tend to be socially embedded or more generally why do actors strive for social embeddedness in a society? What are the benefits in general and for firms

[135] See Charkham, J. P. (1994), p. 349 ff; Fukao, M. (1995), p. 72 ff.
[136] See Ziegler, R. (1984), p. 586.
[137] "Anytime you have two guys sitting on at least two boards, there's room for horse riding." Lawrence White, Professor at the New York University, 2002.
[138] Commonly, any direct or indirect financial participation on the ordinary share capital.
[139] See Mintz, B. / Schwartz, M. (1987), S. 129.
[140] See Windolf, P. / Nollert, M. (2001), p. 63.
[141] See Schmidt, S. (2001), p. 181.
[142] An overview for various forms of governance is provided by Rosenau, J. N. (2002), p. 81.
[143] See Uzzi, B. (1996), p. 676.

specifically? How do embeddedness and network structure affect economic behaviour?[144]

The term "governance" is variously defined in several areas, thus a number of definitions do exist. In the meaning of institutional control governance comprises the processes and systems by which an organization operates; corporate organizations, in particular, often use the term governance to describe the manner in which boards or their like direct a corporation. In line with this perspective are the understandings of *Hirst / Thompson (1997)*. They consider governance „as a set of practices whereby interdependent economic and/or political actors coordinate and/or hierarchically control their activities and interactions. Governance structures are therefore formal and informal institutional devices through which economic and political actors organize and manage their interdependencies. The purpose of such structures is to organize negotiation processes, set standards, perform allocative functions, monitor compliance, reduce conflict, and resolve disputes."[145]

For the purpose of this study we refer to the pragmatic meaning of governance in the way that governance refers to a system-wide structure that both allows and constrains the behaviour of actors, here corporate entities, in interdependent relationships in the absence of an overarching authority or clearly and well-defined hierarchical system. The fundamental idea is that the conceptualization of this logic of action of enterprises can be seen in their "social embeddedness" *(Granovetter, 1985)*. In management literature dealing with network research benefits of structural embeddedness in networks is often described: benefits are among others the contractual flexibility,[146] transaction cost reduction,[147] enhancement of the strategic position in the competitive environment as well as to raise stable and long-lasting profitability.[148] In inter-organizational networks firms can manage their corporate strategies and behaviour, thus exert power and control markets. In other words, corporate networks may be an important means to control

[144] For a comprehensive discussion on these questions see Gulati, R. / Westphal, J. D. (1999), pp. 473-506.
[145] See Hirst, P. / Thompson, G. (1997), p. 362.
[146] Critically discussed in Teubner, G. (2000), p. 125 ff.
[147] Transaction cost theory suggests cost-minimization as a major motivation for firms entering into networks, especially regarding information costs, coordination costs and costs of control. For more see Williamson, O. E. (1994), p. 77 ff.
[148] See Dyer, J.H. / Singh, H. (1998), p. 660 ff. For more see also Windeler, A. (2001), p. 14 ff.

competition and distribute lucrative contracts among the members of the network. [149] *Gerlach / Lincoln (1992)* argue that a dense network of corporate ties can thereby both improve the individual organisation's performance and the nation's competitive position.[150] Furthermore they argue, that "that networks among financial, commercial, and industrial firms in an economy determine significant features of that economy's overall organization and its resulting performance."[151] *Windolf / Nollert (2001)* suggest that the instrument of corporate interlocks can be compared with the phenomenon of intermediary organisations (corporatism). By this means organizational power can be enhanced. The more comprehensively the organisation is embedded in a web of inter-firm ties and the more effective the mechanism of interest separation, the more difficult it gets to organise particular individual interests.[152] *Gerlach / Lincoln (1992)* noted that "network forms appear to be proliferating as corporate downsizing and streamlining often in response to competitive challenges […], have encouraged joint ventures, subcontracting, industria consortia […], and other cooperative arrangements among firms."[153] *Uzzi (1996)* argues that organizational networks operate in an "embedded logic of exchange that promotes economic performance through inter-firm resource pooling, cooperation and coordinated adaptation but also can derail performance by sealing off firms in the network from new information or opportunities that exist outside the network."[154] An organization's network position, the type and value of social ties it maintains within the inter-organizational network and the total network structure shape economic action and organizational performance.[155] This assumption about competitive advantages of social forms of organizations relative to market-based exchange systems (*Powell, 1990; Perrow, 1992*) has led to a number of empirical studies in research examine the argument if firms that are highly socially embedded in organization networks perform better.[156] Indeed, authors found positive correlation between interlock

[149] See Windolf, P. / Nollert, M. (2001), p. 51.
[150] See Gerlach, M. L. / Lincoln, J. R. (1992), p. 508 ff.
[151] Gerlach, M. L. / Lincoln, J. R. (1992), p. 491.
[152] See Windolf, P. / Nollert, M. (2001), p. 51.
[153] Gerlach, M. L. / Lincoln, J. R. (1992), p. 495 f.
[154] See Uzzi, B. (1996), p. 675.
[155] See Uzzi, B. (1996), p. 675 f.
[156] The embeddedness argument, which offers a potential link between sociological and economic accounts of business behaviour (see Uzzi, B. (1996), p. 674 ff).

and corporate performance. They pointed out that this is consistent with the resource dependency theory, which states that interlocking directorship is a "strategy for reducing environmental uncertainty and enhancing corporate performance."[157]

Any linkage between organizations might offer actual or potential strategic advantage to both parties.[158] According to *Granovetter (1992)* the embeddedness of the social relationships is stronger than a mere economic rationale.[159] Resource dependency theory and transaction cost theory offer complementary, and in some ways competing explanations for benefits from interlocks. Both exchange approaches have received the most theoretical and empirical attention in science.[160] Basically, cooptation behaviour in networks aims for a reduction from environmental uncertainties. An enterprise, for example, which has a relatively central position in a network, i.e. is highly linked to many other enterprises, can reduce risks for itself and others ("centrality effect").[161] The centrality of the firm is expected to be correlated with its ability to impact, that is power exert influence on the network through its set of linkages to other firms. According to *Windolf (1994)* this web of enterprises forms an institutional framework of economic governance.[162] Both, resource dependence and transaction cost theory, also suggest that firm performance may be improved through the use of interlocks.

Baker / Faulkner / Fisher (1998) note that other forces play major roles in inter-organizational networks; they argue that other forces play major roles in inter-organizational networks: they show that hazard of dissolution of an inter-organizational tie is a function of power dynamics and competition, as well as institutional forces.[163] The inclusion of power as a force reminds of the importance of resource dependence

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[157] Resource dependency theory (Pfeffer / Salancik, 1978) suggests that no organization can survive alone. In this context, inter-firm ties are used strategically to manage dependencies, i.e. to gain control over competitors or non-competitors. Inter-firm ties can insulate an organization from its external environment and lessen the effects of environmental uncertainty and the degree of dependency. For example, firms hold mandates in the governance organ of other firms, and, "outside" managers are engaged in the governance organ of the organisation. However, perfect autonomy remains unattainable (see Staber, U. (2000), S. 61).

[158] See Jarillo, J. (1988), pp. 1-41.

[159] See Granovetter, M. (1992), p. 25 f.

[160] Dill (1962); Levine / White (1961); Litwak / Hylton (1962); Reid (1964); Benson (1975); Van de Ven (1976); Cock (1977); Pfeffer / Salancik (1978); Zeitz (1980); Gupta / Lad (1983); Van de Ven / Walker (1984).

[161] See Windolf, P. / Nollert, M. (2001), S. 69.

[162] See Windolf, P. (1994), S. 78.

[163] The role of the state in shaping inter-organizational relations is more often assumed than studies.

(Pfeffer / Salancik, 1978), and the inclusion of competition reminds that market forces also drive the dynamics of IORs.[164]

The following sub-chapter provides an overview of possible structural components in network architecture, thus serves as prerequisite for the explorative country studies in Part II. For the purpose of this study, we agree upon the general assumption that enterprises aiming for optimization of their respective microstructure; thus, we assume interlocking directorates and ownership ties to be interdependent. In consequence, some structural components might arise more frequently within the governance network than others thus leading to different structural tendencies in network architecture.[165]

2.4 Governance Systematic: Structural Configurations within Networks

Many researchers have shown, using empirical studies, that social network data possess strong deviations from randomness. Some researchers argue that these deviations are caused by the presence of special structural patterns, a field that social network theorists have studied for years.[166] Recall that our central claim here is that interlocks are interdependent; this interdependence has important ramifications for the way in which particular interlocks might be understood. In other words, we assume that corporate ties do not occur at random or in a way that is determined only by the particularities of any two enterprises involved. Rather, cooptation occurs in a local context of other cooptative interlock ties. Regularities in these contextual patterns give structure to interlock networks, and so provide a means by which particular actors are integrated into a broader interlock network. We claim that actors are likely to have some awareness of these contextual regularities and may use their implicit understanding of these patterns to adapt their cooptation strategy.

[164] See Baker, W. E. / Faulkner, R. R. (2002), p. 528.
[165] See Rank, O. N. (2005), p. 19.
[166] See Wasserman, S. / Pattison, K. (1994), p. 556.

With regard to networks a rather loose structure is characteristic compared to a single organisation.[167] Often the main focus is based on the analysis of the network structure deriving certain structural characteristics using social network analysis.[168] Traditional network analysis can be assigned to the field of sociometry[169] and is attached to quantitative methods.[170] In particular, some aspects of analysis worth to mention are the network macrostructure, actors-specific motivation strategies and the microstructure of actors within the total network of governance relations.[171,172] For the purpose of this study the method is used for descriptive evaluation of the respective corporate networks.[173]

Participants of a pre-defined network establish a certain network structure that may differ in form and intensity. Particular measurements for descriptive analysis we used are listed in Chapter 3.[174] The methodological starting point for this analysis refers to the question of how power relations are distributed between the network actors and how is power shared between certain actors.[175] Given the definition of inter-organizational networks by *Sydow (1992)* he puts a particular emphasis on the poly-centric structure of networks, i.e. he argues on some distribution of power on a limited number of core centers within the network.[176] The focal actors characterised to be embedded strongly into the network holding numerous relations not only have a central position ("special nodes"[177]) within the respective local neighbourhood but often act in a certain role.[178]

[167] See Easton, G. / Wilkinson, I. / Georgieva, C. (1997), p. 274. For a more comprehensive discussion see Sydow, J. (1992), p. 86.
[168] See also Sydow, J. (1992), pp. 121-123.
[169] Sociograms, sociomatrices.
[170] See Renz, T. (1998), pp. 113 f.
[171] See Brockhaus (1996), p. 91 and pp. 94-96.
[172] For a comprehensive overview in network research analysis and the possible features of certain networks see Renz, T. (1998), p. 118 f.
[173] One of the major goals of social network analysis is to discern fundamental structure(s) of networks in ways that (1) allow us to know the structure of a network and (2) facilitate our understanding of network phenomena (see Doreian, P. / Batagelj, V. / Ferligoj, A. (2005), p. 77).
[174] See also Sydow, J. (1992), p. 83 f.
[175] See Waarden, F. van (1992), p. 35; for power relations see Balling, R. (1997), p. 158; for more on network centrality and formal hierarchy within networks see Tichy, N. / Tushman, M. L. / Fombrun, C. (1979), p. 508 / Tab. 1).
[176] See Sydow (1992), p. 78 f; Winkler (1999), p. 40.
[177] See Tichy, N. / Tushman, M. L. / Fombrun, C. (1979), p. 509.
[178] See Renz, T. (1998), p. 192-194.

Network formation is also characterised by the path distance of their actors.[179] Some participants are not tied at all; others are tied with multiple linkages.[180] By this structural formation coalitions or so-called cliques emerge. These groups usually have higher network densities in common.[181] I.e. "sub-networks"[182] arise, that is networks within networks.

Gemünden / Ritter (1997) criticize, that interlock research too often focus on dyad relationships, the complex web of relations is often neglected although it is an essential phenomenon in practice.[183] *Rowley (1997)* underpins the relevance of IORs to be of major importance within a complex environment: "Network models begin where stakeholder research stops – the dyadic relationship – and examine systems of dyadic interactions, capturing the influence of multiple and interdependent relationships on organizations' behaviours."[184]

Networks can be characterized by numerous structural characteristics.[185] Corporate interlocks are particular organizational relationships, which have developed between market and bureaucracy and which likewise have a structure.[186] Microstructure for individual actors within the network indicates the particular strategy and power constellation of this member. I.e. the actors' position is not only determined by the number of relations they held but rather the structure they are embedded in, thus the systematic logic. Of major importance for any evaluation are the particular environmental characteristics of the systems prevalent in different countries.

For any statements that are made for network participants it is essential to delineate a particular network sample, thus network boundaries must be agreed.[187] For the purpose of the analysis in this study the minimum number of participants of a network is per definition three. Selection and number of actors are relevant factors influencing the complexity of the network structure. Next, an overview of the typology of network

[179] See Sydow, J. (1992), p. 85.
[180] See Tichy, N. / Tushmann, M. L. / Fombrun, C. (1979), p. 507.
[181] See Sydow, J. (1992), p. 83.
[182] Waarden, F. van (1992), p. 35.
[183] See Gemünden, H. G. / Ritter, T. (1997), p. 294.
[184] Rowley, T. J. (1997), p. 894.
[185] See Sydow, J. / Windeler, A. (2000), p. 11.
[186] See Windolf, P. / Beyer, J. (1995), p. 3.
[187] See Sydow, J. (1992), p. 97); Evers, M. (1998), p. 20; Renz, T. (1998), p. 200.

structural components forming certain configurations (small sub-graphs) that occur within local neighbourhoods (*Pattison / Roberts, 2002*) of the network in which governance game takes place is presented. Thereby the meanings of dyads and triads can be evaluated relatively easy.

A dyad - a pair of interacting organizations - is the basic unit of analysis in inter-organizational research. In-depths studies of dyads help to make sense of IORs by learning "what flows across the links, who decides on those flows in the light of what interests, and what collective or corporate action flows from the organization of links".[188] Repeated inter-firm dyadic exchanges may lead to interdependencies; social partnership emerges as a primary mechanism for governing business transactions.[189] It can be suggested that network actions are key competitive moves because firms continuously strive to achieve superior network positions, on the premise that different network positions lead to asymmetries in resources and competitive advantage.[190] Dyadic relations between firms are thereby shaped by policies of each firm.[191]

The triads approach to the analysis of inter-organizational networks is a fruitful area of research, especially from the perspective of the nature of market competition as a triad.[192] Triads analysis has a long and rich history in network analysis; see, for example, *Davis's (1979)* review of the Davis / Holland / Leinhardt studies, *Laumann / Galaskiewicz / Marsden (1978)*, *Burt (1992)*, *Gambetta (1993)*, *Gargiulo (1993)*, *Baker / Obstfeld (1999)*, and *Della Porta / Vannucci (1999)*. Triads create opportunities for constantly shifting alliances, as relations between any two actors are affected by appeals to the third. One assumes the goal of enterprises consists of optimizing their (triadic) structure of their respective set of relationships within the network. Since network governance needs to be achieved across the entire network we would expect the interdependence of corporate ties to take forms that are not simply dyadic but rather show triadic patterns of interdependence. Alongside, since interlocks are eventually hold for the purpose of the influence and control,[193] a hierarchical character might be

[188] See Stinchcombe, A. (1990), p. 381.
[189] See Baker, W. E. / Faulkner, R. R. (2002), p. 523.
[190] See Gnyawali, D. R. / Madhavan, R. (2001), p. 431.
[191] See Baker, W. E. / Faulkner, R. R. (2002), p. 523.
[192] See Swedberg, R. (1994), p. 271 f.
[193] See Franks, J. / Mayer, C. (1995), pp. 171-172; Heinze, T. (2001), p. 644.

supposed from the structural tendencies of enterprises in microstructure, understood as an actors' strategic embeddedness by the means of his individual arranged inter-firm relations. *Eccles / White (1988)* show that firms operate in a market but also in a hierarchy.[194]

Based on the insight on theoretical groundwork provided and the many issues and aspects raised in this context an exploratory study is conducted in Part II; we expect to suggest some aggregated tendencies in triadic formation, thus conclude on the corporate behaviour and strategy of the firms regarding the microstructure in governance networks for the three network economies.

In the following, the induced sub-graphs of directed Markov Graphs of order $g = 3$ of all possible kinds are displayed labelled with the particular network configuration. There are 16 different kinds of (non-trivial) triples;[195] however, there is need for only 15 triads as sufficient statistics.[196] From the basic types of configuration more complex structures can be formed by combination.[197] If parameters included of order 4 or more (for example, the stars-parameter[198]), then the number of possible sub-graphs increases from 15 to 25, seen as an extension of the triad count model within the class of Markov graphs.[199] However, *Holland / Leinhardt (1981)* suggested that the triad counts - the numbers of different induced sub-graphs of order 3 - might be appropriate statistics for directed homogeneous Markov graph models[200] with dependence structures having no parameters for stars of order 4 or more.[201] Thus, for the purpose of this exploratory study we employ the triadic analysis.[202] We define $T_{i,j,k}$ as the triad, or 3-subgraph involving n_i, n_j, n_k with $i < j < k$ since the actual order of the actors matters in a

[194] See Eccles, R. G. / White, H. C. (1988), pp. S17-S51.
[195] We assume the minimum number of participants to establish a network to be three.
[196] Three actors without the ties that may exist between them are called a triple; when we consider the ties that may link these three actors we have a triad.
[197] See Burt (1982), p. 56.
[198] See below: additional network structural configurations of higher order.
[199] See Frank, O. / Strauss, D. (1986), p. 841.
[200] Markov graph models introduced by Frank / Strauss (1986) are log-linear with statistics based on dyad and triad counts. Frank (1989), Frank / Nowicki (1993), and Corander / Dahmströhm / Dahmströhm (1998) treat estimation for Markov graphs.
[201] See Holland, P. W. / Leinhardt, S. (1981), p. 33 ff.
[202] An equivalent set of sufficient statistics is the set of triad counts of G, that is, the numbers of induced sub-graphs of order 3 and size 0, 1, 2, and 3 (see Frank, O. / Strauss, D. (1986), p. 836).

triad. For a set of n actors their counts sum to T= $\binom{n}{3}$ triads, i.e. the number of ways that we can take n actors, three a time. We will let $\Im = \{T_{1,2,3}, T_{1,2,4}, \ldots, T_{(n-2),(n-1),n}\}$. The number of ties present or absent in a triad amounts 2^6, i.e. 64 realizations, states, or possible values for a triad.[203] There are sixteen isomorphism classes for the 64 different triad states; these classes are pictured in Figure 4. A simple labelling scheme comes from *Holland / Leinhardt (1970)* and *Davis / Leinhardt (1972)*. Each type has a label with as many as four characters.[204, 205] Because of the nature of the triad types, every one of the $\binom{n}{3}$ triads in a directed graph with n actors must be isomorphic to one of the sixteen classes.

In our research model all fifteen possible triadic structures (without the null-triad) are considered as resulting model parameters. Due to the very large samples in the respective countries we expect relatively low densities. In consequence, with the application of the p* model this leads to the fact that more complex substructures are less likely to occur. In the following, therefore, eight structural configurations, starting from τ_1 to τ_8, are discussed in greater detail.

[203] There are three actors in a triad, and each actor can relate to two other actors. This gives six possible ties. Each of the six arcs can be present or absent, so that there are 64 realizations.

[204] This labelling scheme is sometimes referred to as M-A-N labelling, since it highlights the dyadic states contained within the triad (see Holland, P. W. / Leinhardt, S. (1970), p. 492 ff). For more see Note in Figure 4.

[205] For example, the mutual cyclic asymmetric triad, properly termed the 120C triad, since it has one mutual, two asymmetrics, no nulls, and appears cyclical. For the purpose of the p* model termed network configuration parameter τ_{13}.

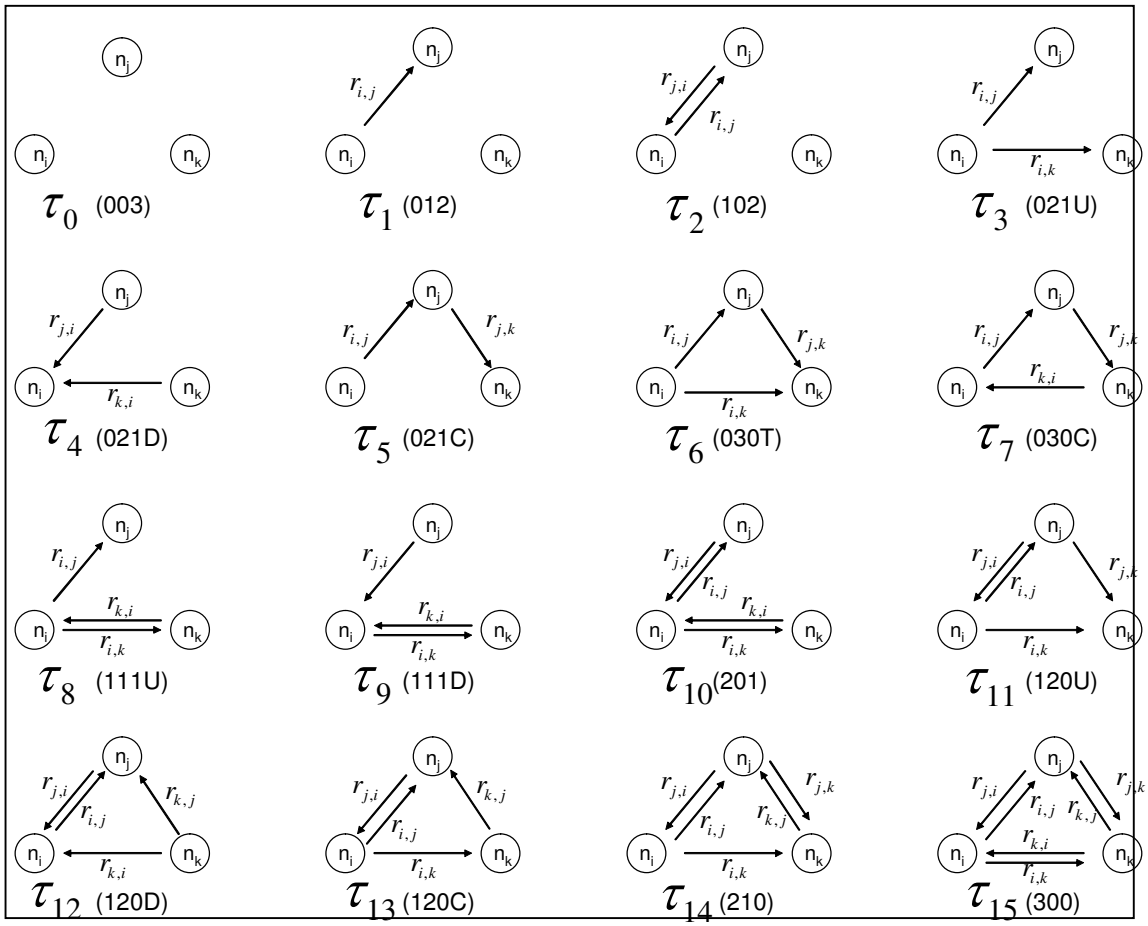

Figure 1: Network Configurations (sufficient sub-graphs of directed Markov graphs of order g=3).[206]

Note: Triple of actors involves n_i, n_j, and n_k of N, where $i \neq j \neq k$; r = social tie of type m between any of two actors of N. Numeric label in brackets identifies the type of triad (isomorphism class with standard M-A-N labeling) where M = number of mutual dyads, A = number of asymmetric dyads, and N = number of null dyads, and if present the fourth character is used to distinguish further among the types ("T" for transitivity, "C" for cyclic, "U" for up, "D" for down).

Source: Own illustration.

According to *Wasserman / Faust (1994)* all possible triads can be partitioned into three basic types: the null triad, dyadic triads and connected triads.

Triad τ_0 (completely null triad) means null dyads between any three actors within the network can be surveyed; i.e., the triad with no arcs present arises when the relationships between all pairs of nodes are null. The simplest configuration in network

[206] See Wasserman, S. / Faust, K. (1994), pp. 566, modified. For an exhaustive description of triad census and associated approaches, see Wasserman, S. / Faust, K. (1994), pp. 556-602.

architecture, the arc triad, is where there is just one asymmetric dyad, i.e., where two actors establish a tie with each other, thus demonstrating a choice regarding whom to partner with (configuration τ_1). Some motives for a dyadic tie formation have been discussed.[207] Moreover, research suggests factors that positively or negatively influence dyadic tie formation, e.g. homophily, cultural similarity, or common national or regional characteristics (geographic proximity). Geographic proximity implies more numerous and repeated opportunities for interactions, further enhancing the likelihood of ties being formed.[208]

More interestingly, for the purpose of this study, are the subsequent architectural network constructions. It should be noted, that configuration τ_1 is a prerequisite for all subsequent network configurations.[209]

Configuration τ_2 (reciprocated or mutual dyad) is constructed by the way in which ties i, j and j, i are both present for each network of type m. This kind of entwinement might reveal a scenario of "mutual hostages" *(Williamson, 1985)* .[210] In case of cross-ownership a high degree of reciprocity may lead to independence of the management from the corporate's owners.[211]

Furthermore, one can differentiate between transitive triadic network configurations (τ_3, τ_4, and τ_5) and intransitive (triadic) structural configurations (τ_6 and τ_7). For the first, distribution of control is distributed unequally with regard to the participants; the configuration is termed transitive because the first actors of a triple does not "choose" the third even though the first chooses the second and the second chooses the third. In the latter category all (three) actors are involved.

[207] See Chapter 2.2.
[208] See Gulati, R. / Gargiulo, M. (1999), p. 1439 ff.
[209] For example, a cyclical triad (configuration τ_7) implies that the three firms in question already have chosen each other as partners.
[210] See Williamson, O. E. (1985).
[211] See Georg, S. (1996), p. 29 ff.

Configuration τ_3 (2-out-star) can be understood as a case in which two separate ties are directed away from the same actors. This effect captures the overall tendency for each element to generate ties of type m (overall expansiveness). In contrast, the 2-in-star can be identified when two firms i and k that are part of an intransitive triad, i. e. both n_j and n_k have ties to i (the tertius), but they are not directly connected to each other (configuration τ_4 or 2-in-star). I.e., configurations in which two separate ties are directed towards the same actors. This effect captures the overall tendency for each element to attract ties of type m (overall attractiveness) There are circumstances under which the 2-in-star would tend to become transitive (τ_6) or cyclical triad (τ_7). Potential drivers of these triadic structures are "resource syndication" *(Coleman, 1988)*[212] and reduction of n_j's network advantage.[213] Motives relate to the cooperative aspects of alliance behaviour *(Ireland / Hitt / Vaidyanath, 2002)* aiming for creating value for all three partners, i.e. a value-enhancing move for all partners (clustering motive). On the other hand, j and k may be motivated to reduce the value appropriated by i, i.e. a value-limiting move aimed at nullifying the extra value appropriated by a partner (countering motive). The latter suggests that firms enter into specific ties to block value appropriation by a partner.[214]

Usually, the social network approach considers direct and indirect relationships.[215] Indirect relations emerge if a corporate actor n_i sends a manager onto the board of a second firm n_j. The latter parallel sends a member of its governance organs into a third party n_k. This configurational structure is labelled τ_5 (2-mixed-star). In short, configurations in which a tie is directed away from an actor to which another tie is directed to. Chains with more actors involved are possible; however, it can be assumed that the degree of efficiently might decrease, i.e. the longer any chain the more influence and control is loosen on the way.

[212] For example, actor i, j, and k may engage in a tripartite alliance because each one possesses a critical complementary resource (see Madhavan, R. / Gnyawali, D. R. / He, J. (2004), p. 922.
[213] See Burt, R. S. (1992); Uzzi, B. / Gillespie, J. (2002), p. 595 ff.
[214] For more on network transitivity effects see Uzzi, B. / Gillespie, J. (2002); for an empirical study embodying the clustering and countering logics in networks see Madhavan, R. / Gnyawali, D. R. / He, J. (2004).
[215] See Rank, O. N. (2004), p. 7.

Any given trio of actors can form a transitive triad (configuration τ_6) if the ties $n_i \rightarrow n_j$, $n_j \rightarrow n_k$, and $n_i \rightarrow n_k$ exist.[216] This particular triad is also called cyclic asymmetric triad. Formally, all configuration in which three elements form a transitive triad.

τ_7 demonstrates cyclic triads. Here, the actor is connected indirectly with itself via one (or more) third actor(s). Formally, this structural pattern can be described as a configuration in which three ties of type m form an intransitive cycle such as ij, jk and ki With respect to shareholdings it means that a company holds partly or fully shareholdings of the own company. In fact, those structural components can hardly be identified due to lack of transparency.

Cyclic triads can be found, for example, within the German ownership network.[217] Another example is France, where cyclic triads (autocontrôle) can also be found,[218] generally used to shield family ownership in large enterprises.[219]

Subsequent network configurations $\tau_8 - \tau_{15}$ getting more complex and comprising structural components that can be taken from their predecessors. Here, a formal description and interpretation of these particular triadic configurations is neglected. The most complex configuration τ_{15} (completely mutual triad) is formed of all three actors reciprocally linked with each other. I.e., the triad with all arcs present arises when the relationships between all pairs of nodes are mutual.

Triads themselves can manifest many interesting structural properties, such as tendencies toward transitivity or reciprocity. Certain triads should occur within the networks if behaviour is, for example, transitive, various triads are not possible, or at least should not occur, if actor behaviours are transitive. In the country studies following in Part II of this work we have particular networks under investigation

[216] Formally, a relation is transitive if every time that $n_i \rightarrow n_j$ and $n_i \rightarrow n_k$, then $n_j \rightarrow n_k$ (see Wasserman, S. / Faust, K. (1994). For more about formats and drivers of transitive triads (clustering-driven consortium vs. countering-driven consortium) see Madhavan, R. / Gnyawali, D. R. / He, J. (2004), p. 920.
[217] See Adams, M. (1994), p. 150.
[218] See Morin, F. (1977), p. 221.
[219] For "structure d'autocontrôle" see Morin, F. (1974, 1989).

studying whether certain propositions are viable. Certain hypotheses are tested empirically and propositions are followed from the observed network data with regard to structure and network systematic. Based on model estimation of the probabilities of presence or absence of certain structural patterns found in triads (micro-structural tendencies) we attempt to conclude on a general actors' behaviour in the particular networks.

3 RESEARCH MODEL

On Part II of this work - the empirical level - the major part is formed by the individual country studies investigating mainly the underlying structural logic of pre-defined governance networks.

At first, in the present chapter a comprehensive discussion of research methodology is presented. The chapter is subdivided into three sections: first, we agree on some terms and prevalent in Germany, France and the U.K based on empirical data. As p* models can be approximated by logistic regressions, thus giving the researcher easy access to a very large wealth of modelling tools,[220] a brief introduction to regression analysis is given next; thereafter the basics of logistic regression are introduced to the Reader.

The aim is not to present a scientific treatise on regression analysis, but rather to set the basic understandings to better retrace the particular research model employed to investigate the structural logic of the governance networks. In the third section, the research model, the p* social network model developed by *Pattison / Wasserman (1996; 1999)*, is described.

3.1 Terminology and Notation

Before we move into logistic regressions and p* social network models we will first give some notation on network statistics which we will use throughout the following chapters. With regard to the definition of a network as well as the specification of the p* model we mainly employ the notation of *Pattison / Wasserman (1999)* und *Anderson / Wasserman / Crouch (1999).*

We begin with a directed graph G, a single set of nodes $N = \{1,2,...,n\}$ with n social actors and a collection of r sociometric relations (or arcs) that specify how two actors i and j are relationally tied together.[221] It is common to use this mathematical concept to represent a social network.

[220] See Anderson, C. J. / Wasserman, S. / Crouch, B. (1999), p. 44.
[221] See Wasserman, S. / Faust, K. (1999), p. 20.

Relational data within inter-organizational networks[222] can be differentiated according to their type and structure.[223] R denotes the set of sociometric relations with $R = \{1,2,...,r\}$. The content of the specific network ties we wish to study is directorate interlocks and cross-shareholdings; i.e. in this context, of interest to us will be the corporate network with either 1 or 2 relations that is interlocking directorates and ownership tie recorded for each pair of firms in the given set of corporate actors. Consequently, within the relational systems (national interlock networks), two 'partial' networks are identified: one comprising personal relations and the other established by capital relations.[224] The whole of these relations is seen as to form the 'total' corporate network.

The reason for the limitation on these two types of corporate ties (i.e., credit or supplier relationships, financial ties etc.) can be found in the availability of data; no systematic and publicly accessible data for other types of networks could be found. However, these corporate relations are among the most important types within the field of corporate governance.

The levels of measurement relational data can be distinguished by directionality (undirected, directed) and numeration (binary, valued). The subject of study here is directed data and the relations between firms surveyed with their direction.[225] With regard to interlocking directorates, valued relational data and ownership ties coded in binary form were collected. Values typically indicate the strength of a relation rather than its mere presence or absence. In this case, we understand if a company delegates more than one manager to the management body of another corporate unit (multiple relationships).

The dichotomous social relation, X_m with $m \in R$, is a set of ordered pairs of actors (i, j) that indicates the existence or absence of a relation of a certain type m, indicated by a binary random variable x_{ijm}. Applied to the network of directorates that means firm

[222] Networks where actors are enterprises.
[223] See more on this in Ibarra, H. (1993); Brass, D. J. / Butterfield, K. D. / Skaggs, B. C. (1998).
[224] Partial network is constructed to select particular aspects of the total network for attention, to show the corporate network in relation to a particular aspect of type of relationship.
[225] The most studies use the dyad as the basic experimental unit (see Weick, K. E. / Penner, D. D. (1966), p. 191).

i delegates one or more top managers onto the governance organ of firm j (interlock network); for the capital network the case is if one company i holds a participation of the company j's share capital.

For the empirical investigation of the structural logic within the governance network we employ on directional, dichotomous relations, i.e. the value of the relation - number of managers sent onto the management board of another company or the degree of share ownership in percentage - is not considered explicitly.[226] Although this is a more simple approach it does not limit the statements and consequences based on the investigation of the governance systematic using the p* social network model. For a dichotomous relation, a dyad is a pair of actors and all the ties between them, and can be in one of four states: null (no ties), asymmetric (one tie in either the one or the other direction), and mutual (two ties).

The social relations of each network emanating from the two considered types of relationships can be represented by a $n \times n$ sociomatrix X where the entry (i,j) in the matrix we denote by x_{ij}, that is the value of the tie from actor i to actor j on that relation. For a dichotomous relation we define x_{ij} equals 1 if actor i chooses actor j on relation r and 0 otherwise:

$$x_{ij} = \begin{cases} 1 & \text{if } (i,j) \in X_m \\ 0 & \text{otherwise} \end{cases}$$

As noted above, a social relation can be either directed ($i \to j$ may differ from $j \to i$) or non-directed (there is, at most, one non-directed tie connecting i and j), and can also be valued, that is, the tie from i to j has a non-dichotomous strength or value.[227]

[226] Extensions of the triad methodologies to valued relations are quite interesting, but because of the complex mathematical structures that result, such research has not been undertaken.
[227] For the purpose of the research model we employ dichotomous, directed network data.

Dyadic relational data can be represented in adjacency matrix form[228], an intuitive way of modelling relational data and a framework in which the coded data is efficiently organised. In general, data matrices must be constructed before network analysis can be undertaken.[229] Based on this, standard statistical procedures can be run. Illustrated for the set of interlocking directorates, the matrix approach to relational data can be understood as follows: An interlocking directorship exists when a particular person sits on the management board of two or more companies. Corporate actors can be embedded in a network through the delegation of a top manager to another firm (outdegree) or when another firm holds a seat in the top management of his firm (indegree). Such a person is termed a multiple director. His or her presence on the two bodies establishes a relation between the companies. In the particular matrix, each cell shows more than the mere presence or absence of an interlock; it also shows the number of directors in common between a pair of companies (number of co-opted members). The cells contain actual values rather than simply binary digits, as the companies may have more than one director in common. The number of directors in common between two companies is an indicator of the strength of a relation.[230]

With regard to ownership, ties between firms occur when two actors become linked to each other, with one company holding share ownership in another entity that forms part of the class of data. The sociomatrix of ownership ties contains directed data in binary form.

The matrix describing the relations among a set of agents can be converted into a graph ('sociogram')[231] of points connected by lines expressing the qualitative patterns of connection among points; the direction of the relationships in the graphs is indicated

[228] The most general form of relational data matrices for social networks is the case-by-affiliation matrix (generally termed 'incidence' matrix), in which agents are shown in rows and their affiliations in columns. The basic data matrix can be transformed into two square matrices ('adjacency' matrices), one describing the rows of the original matrix and the other describing its columns. In the case-by-case matrix, both the rows and the columns represent the cases. An entry in the cell of the matrix where a column intersects with a row indicates that there is a tie (a relation) between two actors. The second square matrix shows affiliations in both its rows and columns, with the individual cells showing whether particular pairs of affiliations are linked through common agents (see Scott, J. (2000)).

[229] See Scott, J. (2000), p. 5.

[230] Having four directors in common, these two companies may be understood as being 'closer' than those which had only two directors in common.

[231] A sociogram is a picture in which social units are represented as points in two-dimensional space and relationships among pairs of actors are represented by lines linking the corresponding points.

by an arrow ('directed graph').[232] As noticed by *Boyle (1969)*, today it seems almost a given in sociometry that sociograms are somehow very useful to understand the social structure of the apparently chaotic relationships which could inhere amongst members of any group of more than three actors. Based on the sociogram one can look for structure that are difficult to uncover by visual inspection of their corresponding matrices.[233] Thus, sociograms provide a simple and elegant way of representing a large amount of relational information concerning social interaction;[234] well-drawn graphs or diagrams bring attention to important features of the network, such as the presence of subgroups, the relative importance to centrality of actors, and often convey descriptive information in a form that is more easily appreciated than are numeric summaries of matrices.

The means of representing a relational data matrix by a set of actors as collections of points connected by lines allows the investigation of the network structure from the standpoint of each of its members simultaneously, and not simply from the standpoint of a particular focal individual, and could be analysed by using the mathematical ideas of graph theory[235]. The sociogram is useful regarding the visual appreciation of the structure[236] and is equivalent to the case-by-case matrix in the information that it contains.[237] In the graph we use in our studies, the pattern of connections is important, not the actual positioning of the points on the page (the relative position of two points, the lengths of the lines which are drawn between them, or the size of character used to indicate the points is of little importance). However, it can be quite difficult to construct sociograms depending on the size of the data sets. In general, in large-scale networks, any visual appreciation of the structure is lost. The principle of the case-by-case matrix has been most widely adopted.

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[232] In an undirected graph, the relation of *i* to *j* is assumed to be identical with the relation of *j* to *i*.

[233] Visualization is an integral part of social network analysis (see McGrath, C. / Blythe, J. / Krackhardt, D. (1997); Freeman, L. C. (2000)).

[234] A huge variety of graphical representations, e.g. representing the network in three dimensional graphs, or showing the linkages dynamically (see Freeman, L. C. (1998)).

[235] *Cartwright / Harary (1956)* had outlined the basic idea of representing groups as collections of points connected by lines.

[236] The visual simplicity could be lost with large-scale samples.

[237] Two-dimensional spatial representations, e.g. sociograms are widely used by network analysts and have proved quite useful for presenting structures of influence among corporate interlocks (see Levine, J. H. (1972), p. 14).

Sociometric matrices and their corresponding graphs offer a straightforward way to measure and illustrate structures of interest and governance to inter-organizational researchers such as reciprocity, transitivity, cycles, etc. Before we examine the structural logic, the focus is on mapping the structure of inter-firm networks (formal description) and evaluating the network properties on the firm-level and social structural positions of groups in the three network economies.[238] The specific techniques we consider are available from standard network software packages; some involve procedures that could be easily computed on using a spreadsheet.[239]

A description of the particular web of interlocks for a set of organizations[240] could be given taking advantage of the social network perspective. Social network analysis, a distinct[241] research perspective within the field of social sciences, is a set of methods used for the structural analysis of social science data, methods that are specifically geared towards an investigation of the relational aspects of social structures.[242] Structural analysis refers to the process of "studying directly how patterns of ties allocate resources in a social system" (*Wellman / Berkowitz, 1987*) and is part of a growing trend in the social sciences toward seeking explanation, not in the intrinsic properties of social units, but in the networks of structural relations in which they are embedded.[243]

The network perspective has proved fruitful in a wide range of social and behavioural science disciplines.[244] The social network perspective views characteristics of the social units as arising out of structural or relational processes or focuses on properties of the

[238] Social structural positions could be represented numerically and compared across the network.
[239] Numerous software packages are available for different kinds of network analysis. A most up-to-date review of a continually changing field is presented by Huisman / van Duijn (2005). Besides, a number of visualization software packages are available. However, there is no single best kind; the package of choice depends very much on the particular questions that are of interest to the analyst.
[240] Boundaries of the networks built from the relations of a set of connected agents have to be confined by the particular sample of actors (reputational approach). However, this is an imperfect representation of the full network as connections outside this locale are ignored.
[241] This is distinct research perspective, as social network analysis is based on the assumption of the importance of relationships among interacting units. […] Network analysis operationalizes structures in terms of networks of linkages among units (see Wasserman, S. / Faust, K. (1999), p. 4).
[242] See Scott, J. (2000), p. 39. There are several collections of papers that apply network ideas to substantive research problems (see Wasserman, S. / Faust, K. (1999), p. xxix).
[243] See Gerlach, M. L. / Lincoln, J. R. (1992), p. 491.
[244] See a list of topics that have been studied by network analysts in Wasserman, S. / Faust, K. (1999), p. 5.

relational systems themselves.[245] At the inter-organizational level, network analysis charted the effects of networks on firms, industries, and society. In order to assess the characteristics of governance networks - its structure and in a further step, any systematic within a governance network that could be identified - therefore, a methodological tool for analysing social systems of interweaving relations in social studies is given by the social network analysis.[246]

Today, the field of network analysis boasts an impressive array of network metrics that capture key structural indicators such as centrality, autonomy, density, mutuality, and transitivity at the actors, sub-group, and global levels of the network.[247] The various graph-theoretic characteristics about the relation from the sociomatrix X is a useful approach to examine distributions and summary statistics on a variety of network variables.[248] We use a variety of graph characteristics and statistics throughout the study; most of such quantities are defined in the early chapters of *Wasserman / Faust (1994)*. Moreover, we attempt to identify any core-periphery-structures[249] in the interlock networks.[250] The core of a core-periphery structure can be seen as a group with maximum group centrality; in this case, the core is in fact a dominating set.[251]

By this means, a number of interesting comparisons can be made from the distributions and central tendencies of such network variables in terms of form and properties of the corporate networks in the different economies. However, standard statistical methods alone are not suitable to study the patterns of relationships in

[245] See Wasserman, S. / Faust, K. (1999), p. 8.
[246] A broad and comprehensive discussion of network analysis methodology is presented by Wasserman / Faust (1994). A good handbook on social network analysis, among others, is also Scott (2000); In addition, there are some books on special topics in network methods and a number of articles reviewing network methodology (see Wasserman, S. / Faust, K. (1999), p. xxix).
[247] See Wasserman, S. / Faust, K. (1994) for a comprehensive review.
[248] Both statistical and descriptive uses of network analysis are distinct from more standard social science analysis and require concepts and analytic procedures that are different from traditional statistics and data analysis (see Wasserman, S. / Faust, K. (1999), p. 5).
[249] The core-periphery structure is ubiquitous in network studies. The discrete version of the concept is that individuals in a group belong to either the core, which has a high density of ties, or to the periphery, which has a low density of ties. The density of ties between the core and the periphery may be either high or low. Borgatti / Everett (1999) presented several formal models for core-periphery structures, which were incorporated into the most widely used network analysis program, UciNet (Borgatti / Everett / Freeman, 2002), for general application.
[250] Whereas block model analysis identifies companies according to their positional similarity, clique analysis examines network connectivity.
[251] See Everett, M. G. / Borgatti, S. P. (2005), p. 69.

corporate networks. Social network analysis is particularly well suited for the analysis of social structures,[252] a method appropriate to relational data collected in the studies in terms of the particular needs of data handling and analysing. The general applicability of network analysis is such that the units in a network may be measured at any level: individuals, organizations, or nations. *Barnes (1972)* has contrasted two approaches to social network analysis: the 'ego-centric' and 'socio- centric' approach. For the purpose of this study a 'socio-centric' approach is chosen which focuses on the pattern of connections in the network as a whole.[253]

While it is possible to undertake quantitative and statistical counts of corporate ties, network analysis allows measurement of structures and systems[254] which would be almost impossible to describe without relational concepts, and also provides tests of hypotheses of these structural properties.[255] As the focus of this investigation lies on both personal and capital relations, the pairs of actors participating in the respective governance network can be connected by more than on individual relationship; i. e., two firms can be linked either by a director sitting onto the respective governance organ of the firm as well as tied together by cross-shareholdings (r=2; bi-variate case), which means two matrices do exist X_1 and X_2. This results in a triple-matrix X spanning $n \times n \times r$. For the purpose of the p* modelling we will assume here that the entries in the matrices are random variables. Accordingly, sociomatrices represent a set of random variables. The realization of these set of random variables is represented by x.

3.2 Linear Regression Review and the Basics of Logistic Regression

Before we move into p* social network models, first, some basic concepts from a more familiar technique, linear regression analysis is reviewed.[256]

[252] See Rank, O. N. / Wald, A. (2000), p. 16.
[253] Barnes (1972) holds that the socio-centric approach is of central importance as the constraining power of a network on its members is not mediated only through their direct links (see Scott, J. (1990), p. 73).
[254] Network analysis consists of a body of qualitative measure of network structure (e.g. density, fragmentation and centralisation).
[255] See Scott, J. (2000), p. 3; Wasserman, S. / Faust, K. (1999), p. 17.
[256] For a full treatment of this topic, see Weisberg, S. (1985), Neter, J. (1996), Fox, J. (1999), and Seber, G. A. F. / Lee, A. J. (2003).

One goal in regression analysis is to relate potentially "important" explanatory variables to the response variable of interest. Formally, the basic model states,

$$Y_i = \beta_0 + \beta_1 x_{i1} + \beta_2 x_{i2} + \ldots + \beta_p x_{ip} + \varepsilon_i \qquad (1)$$

where Y_i is the response for the i th case, $i = 1,2,\ldots,n$ (number of cases)
$x_{i1}, x_{i2}, \ldots, x_{ip}$ are the explanatory variables for the ith case,
$\beta_0, \beta_1, \ldots, \beta_p$ are regression coefficients, or model parameters, to be estimated,
and ε_i is the random error term for the ith case.

It is often convenient to develop a more compact notation to discuss regression models. In vector notation, model (1) can be restated for the ith case as,

$$Y_i = x_i^T \beta^T + \varepsilon_i \qquad (2)$$

where $x_i^T = \left(1, x_{i1}, x_{i2}, \ldots, x_{ip}\right)$ and $\beta^T = \left(\beta_0, \beta_1, \beta_2, \ldots, \beta_p\right)$.

Y_i, x and β represent the response, the vector of explanatory variables and the parameter vector. For the purpose of later notation, we could have just as well defined

$$X_i = z_i^T \theta + \varepsilon_i .$$

Without detailing the computations, estimates of the β coefficients can be found such that the sum of the squared differences between the observed responses (Y_i) and the responses predicted by the model ($\hat{Y}_i$) is at a minimum. More formally, the least squares estimates of the regression coefficients minimize the quantity,

$$\sum_{i=1}^{n} (Y_i - \hat{Y}_i)^2 = \sum_{i=1}^{n} \hat{\varepsilon}_i^2 \qquad (3)$$

and are usually termed $\hat{\beta}$. Plugging the observed values of the explanatory variables into the estimated regression function, $\hat{Y}_i$ terms are obtained:

$$\hat{Y}_i = \hat{\beta}_0 + \hat{\beta}_1 x_{1,i} + \hat{\beta}_2 x_{i,2} + \ldots + \hat{\beta}_p x_{i,p} \qquad (4)$$

If the model fits the observed data well, then the sum of squared errors is small relative to the total variation in the response. The "degree" of model fit is often captured

by the index, R^2, also termed coefficient of determination. When the model fits perfectly, $\sum_{i=1}^{n} \hat{\varepsilon}_i^2 = 0$, and $R^2 = 1$.

One can glean some information about the importance of each explanatory variable from a regression by inspecting the sign and magnitude of the estimated regression coefficients. In general, the model states that the response Y_i changes by a factor of β_j when the j[th] explanatory variable increases by one unit while the remaining explanatory variables are held constant. Since the explanatory variables are often measured on different scales, the magnitude of these coefficients reflect as much about the scale of the data and about the presence or absence of other correlated predictor variables as they convey about the importance of the predictor.

Therefore, an alternative strategy of comparing model fit is often used to "tease out" the importance of each explanatory variable. One can compare the fit of the full model including all predictor variables against a reduced model that does not include a parameter for one or more explanatory variable, i. e.

full model (F): $Y_i = \beta_0 + \beta_1 x_{i1} + \beta_2 x_{i2} + \beta_3 x_{i3} + \varepsilon_i$

reduced model (R): $Y_i = \beta_0 + \beta_1 x_{i1} + \beta_2 x_{i2} + \varepsilon_i$

Given independence and normality assumptions about the errors, well-known theory tells us that the difference in fit between the two models follows an F-distribution with numerator degrees of freedom equal to the difference in the degrees of freedom of the full versus reduced models $(df_F - df_R)$ and denominator degrees of freedom equal to $n - p - 1$. Thus, we can compute the observed F-value via the formula,

$$F_{ObS} = \frac{(R_F^2 - R_R^2) / (df_R - df_F)}{(1 - R_F^2) / df_F} \tag{5}$$

and compare it to an F-distribution with the appropriate degrees of freedom. If the result is statistically significant, then one can conclude that setting the Interview parameter to zero results in an appreciable loss of fit, suggesting that this explanatory variable should

be retained in our model. Conversely, if the observed F-statistic is not significant, one may choose to adopt the more parsimonious 2-predictor model. Although the details differ, we will use this same strategy to evaluate the logistic regression model described hereafter.

Logistic regression is useful for situations in which you want to be able to predict the presence or absence of a characteristic or outcome based on values of a set of predictor variables. It is similar to a linear regression model but is suited to models where the dependent variable is dichotomous. Logistic regression coefficients can be used to estimate odds ratios for each of the independent variables in the model.

The function relating the explanatory variable to the response is nonlinear, and is of the form,

$$\Pr(X = 1) = \frac{\exp(\theta_0 + \theta_1 z_1)}{1 + \exp(\theta_0 + \theta_1 z_1)} \tag{6}$$

and is called the logistic regression function.

This model can be reformulated into a linear model by considering the log odds of the response, or the log of the ratio of the probability that the response equals one to the probability that it equals zero, or

$$\log\left(\frac{\Pr(X = 1)}{\Pr(X = 0)}\right) = \theta_0 + \theta_1 z_1 \quad . \tag{7}$$

The response, X, has been transformed from a variable that ranges between one and unity to a variable called a logit that ranges from -∞ to +∞. When the responses zero and one are equally likely, the logit equals zero, but is positive when one is the more probable outcome and negative when zero is more probable.

A third formulation of the logistic regression model provides a possibly more intuitive interpretation of the θ coefficients. Rather than considering the natural logarithm of the odds that the response is unity, one can consider the odds ratio itself, or

$$\frac{\Pr(X=1)}{\Pr(X=0)} = \exp(\theta_0 + \theta_1 z_1) = e^{\theta_0}(e^{\theta_1})^{z_1} \tag{8}$$

Thus, for a unit increase in the explanatory variable z_1, the odds ratio that the response equals one changes by a factor of $\exp(\theta_1)$.

We have yet to determine if these probabilities predicted by the model correspond well to the observed data. Thus, we now turn to a technique useful for assessing model fit. As described earlier, R^2 is a natural measure of fit for linear regression models as it is directly related to the least squares criterion used to obtain the "best" estimates of the regression parameters. Logistic regression coefficients are estimated by maximum likelihood, using an iteratively re-weighted least squares computational procedure. The "natural" measure of model fit is given by the maximized log likelihood of the model given the observed data, and denoted by L. Similar to the linear regression analysis where we can compare the fit of two linear regression models using (5), we can compare the fit of two logistic regression models by inspecting the likelihood ratio statistic,

$$LR = -2(L_R - L_F), \tag{9}$$

where L_F is the log likelihood of the full model and L_R is the log likelihood of the reduced model (obtained by setting q of the parameters in the full model to zero). When the full model "fits" and the number of observations is large, *LR* is distributed as a chi-squared random variable with q degrees of freedom. Therefore, if the difference in fit between two models is small relative to the χ^2_q-distribution, one can adopt the model with fewer parameters without suffering an appreciable loss of fit.

Guided by the discussion in this section and intuition already developed for linear regression models, we have the basic components necessary to estimate, test the fit of, and interpret logistic regression models for binary responses. We now turn to a class of models for the binary response of interest in this study, a social network relational tie.

3.3 Logit p* Social Network Model: Description and Interpretation

Statistical models have been used by researchers to study social networks for almost 60 years.[257] Recent contributions in social network analysis, the Markov random graphs of *Frank / Strauss (1986)*[258] and especially the estimation strategy for these models developed by *Strauss / Ikeda (1990)*, described in brief in *Strauss (1992)*, provide substantial benefits to express interesting structural assumptions, thus useful to address a variety of substantive questions about structure in social networks. In general, log-linear statistical models are used to characterize random graphs with general dependence structure and with Markov dependence.[259] The goal of this large class of graph models, namely Markov models, and their more general forms, labelled p*, is the quantitative examination of the stochastic properties of social relations and the actors of a particular network. I. e., p* models provide a statistical framework to test hypotheses like that of "unequal access". One can frame the unequal access notion in terms of the presence or absence of certain network structures. Network statistics, e. g. in form of sociomatrices capturing the network data, intend to capture the existence of such structure. But in order to determine the statistical importance of these counts, a statistical model becomes necessary. These log-linear models expand considerably the class of structural models that can be investigated within the exponential family first proposed by *Holland / Leinhardt (1981)*.[260] The advantage of the exponential random graph models is that they model global network structure as the outcome of processes

[257] For an actual survey of the research of sociometricians on social network study see Carrington, P. / Scott, J. / Wasserman, S. (2005).

[258] Random graphs have been used to describe social networks (and also other empirical data structures) involving pair wise relationships. The class of exponential random graph models for networks were first introduced into network analysis through the Markov random graphs of Frank / Strauss (1986). For more see Frank, O. / Strauss, D. (1986), p. 832 f.

[259] Markov random graph models assume that two network couples (i, j) and (r, s) are independent unless they share a node. The resulting sub-graphs for the Markov graph model relate to dyadic and triadic configurations (see Frank, O. / Strauss, D. (1986), p. 832). For a full description of dyadic and triadic configurations see Chapter 3.4.

[260] See Wasserman, S. / Pattison, P. (1996), pp. 401-402. Log-linear graph models with parameters representing, for example, reciprocity, and other sociometric properties of social networks were investigated by many researchers more, for example and Fienberg, S. E. / Meyer, M. M. / Wasserman S. S. (1985).

occurring in local social neighbourhoods[261] (*Pattison / Robins, 2002*) of the network.[262] Given a particular set of dependence assumptions, and a consequent specification of the form of local social neighbourhoods, the resulting random graph model expresses the probability of a (global) network structure as a function of parameters and observed statistics pertaining to certain network configurations (small sub-graphs) that occur within local neighbourhoods of the network.[263]

The class of p* models is viewed as an advancement of dyadic interaction models[264] incorporating Markovian assumption.[265] The model p* was first discussed by *Frank / Strauss (1986)*, who termed it a distribution for a Markov random graph; further developments, especially commentary on estimation of distribution parameters, were given by *Strauss / Ikeda (1990)*. Wasserman / Pattison (1996) further elaborated this family of models, showing how a Markov parametric assumption provides just one of many possible sets of parameters. The parameter reflects structural concerns, which are assumed to govern the probabilistic nature of the underlying social and/or behavioural process.[266] Multivariate p* models can be assigned to likelihood-based approaches to multivariate graph modelling,[267] first proposed for uni-variate networks by *Wasserman / Pattison (1996)* with further elaborations for multivariate networks provided by *Pattison / Wasserman (1999)*. Markov graphs permit dependencies among any ties that share a node, for example, x_{ijm} and x_{ijkm}, or x_{ijm} and x_{jkm}.[268] Consequently, entries in the sociomatrices will be assumed to be random quantities in the context of the p* model.

[261] A local social neighborhood can be construed as a set of network tie variables that are hypothesized to be mutually conditionally interdependent (see Pattison, P. E. / Robins, G. L. (2002), p. 301 ff).

[262] The form of these local social neighbourhoods is determined by a hypothesized dependence structure, that is, by a set of assumption about which pairs of potential ties are dependent, conditional on the values of all other tie variables. A common dependence assumption has been the Markovian one (Frank / Strauss, 1986) in which two variables are assumed to be conditionally independent only when they do not have nodes in common (see Robins, G. / Pattison, P. / Woolcock, J. (2004), p. 262).

[263] See Robins, G. / Pattison, P. / Woolcock, J. (2004), p. 262.

[264] See Holland, P. W. / Leinhardt, S. (1977, 1981); Fienberg, S. E. / Wasserman, S. (1981).

[265] See Frank, O. / Strauss, D. (1986), p. 832 ff.

[266] See Wasserman, S. / Robins, G. (2005), p. 148.

[267] See Pattison, P. / Wasserman, S. (1999), p. 169 ff.

[268] See Wasserman, S. / Pattison, P. (1996), p. 404; Albert, K. (2002), p. 32. In applications it is natural to assume that the graph reflects some probabilistic interdependencies or interactions that cause the dyads to be dependent (see Frank, O. / Strauss, D. (1986), p. 832.

All functions of the observed data x represent the set of explanatory variables. These statistics will be denoted by $z_1(x), z_2(x),..., z_t(x)$. Any graph-theoretic characteristic of the relation, for example, the number of relational ties or the number of reciprocated ties is a potential explanatory $z_k(x)$. The model parameters, the elements of the vector θ, will be the coefficients of a linear function of these explanatory variables as in standard linear models:

$$\theta_1 z_1(x) + \theta_2 z_2(x) \cdots + \theta_t z_t(x)$$

where $\boldsymbol{\theta}$ is the vector of model parameters relating to network configurations (local sub-graphs) of particular types depending on the model and **z**(**x**) is the vector of network statistics pertaining to a configuration.

The response variable is the probability of the observed x, Pr (X=x); but since probabilities must be between 0 and 1, one usually models not the probability, but a logarithmic transformation of it. P* models postulate that the probability of an observed graph is proportional to an exponential function of a linear combination of the network statistics, or

$$\log[\Pr(X=x)] \propto \theta_1 z_1(x) + \theta_2 z_2(x) \cdots + \theta_t z_t(x). \qquad (10)$$

Now all that we must do is normalize the right side of (10) to turn this into a proper likelihood-based approach so that the sum of $\Pr(X = x)$ over all possible directed graphs is unity. From these concerns, comes the basic log linear model:

$$\Pr(X=x) = \frac{\exp\{\theta' z(x)\}}{\kappa(\theta)} = \frac{\exp\{\theta_1 z_1(x) + \theta_2 z_2(x) \cdots + \theta_t z_t(x)\}}{\kappa(\theta)} \qquad (11)$$

where θ is a vector of the t model parameters relating to the presence or absence of a particular network configuration (local sub-graphs) in the observed network, $z(x)$ is the vector of the t explanatory variables and κ is a normalizing quantity that ensures that the probabilities sum to unity. The θ parameters are the 'regression' coefficients; in practice, they are unknown a priori, thus must be estimated.

Equation (11) expresses a distribution of random graphs, each of which can be construed as arising from an agglomeration of the configurations represented by the parameters. So the parameters can be interpreted as indicating the strength of the local structural effects that produce a graph. For example, suppose that one element of $z(x)$ is a count of the number of a specific network configuration (local sub-graphs)[269] and the θ parameter corresponding to the count is large and positive. Such a model predicts that networks with a large number of this particular configuration will be observed with a higher probability than those with a lesser number of the same sub-graph.[270] For the different network statistics z numerous examples can be found. Based on the existing empirical work to p* models these z-statistics refer to all conceivable dyadic and triadic configurations[271].[272]

Models of the form (11) are referred to p* models.[273]

Due to the difficulty in analytically specifying the $\kappa(\theta)$ term in the probability function (10), the model does not lend itself well to maximum likelihood estimation. Fortunately, the model can be reformulated in logit terms and fitted approximately by logistic regression, as described by *Strauss / Ikeda (1990)*, reformulate this loglinear model (11) as a logit model for the probability of each network tie, rather than the probability of the sociomatrix as a whole, using the dichotomous nature of the random variable x_{ijm}.

According to *Wasserman / Pattison (1996)* to specify multivariate p* models, first three new sociomatrices from X need to be created. We define X^{+}_{ijm} the sociomatrix for the relation X formed from type m where the tie from actor i to actor j is forced to be present ($x_{ijm}=1$), X^{-}_{ijm} the sociomatrix for the relation X formed from type m where the tie from actor i to actor j is forced to be absent $(x_{ijm}=0)$. Lastly, we define X^{C}_{ijm}

[269] See Chapter 3.4.
[270] See also Wasserman, S. / Pattison, P. (1996), p. 415 for more on model interpretation.
[271] See Chapter 3.4., Figure 4.
[272] See Wasserman, S. / Pattison, P. (1996), pp. 411-416; Pattison, P. / Wasserman, S. (1999), pp. 173-175.
[273] See Wasserman, S. / Pattison, P. (1996), p. 406; Anderson, C. J. / Wasserman, S. / Crouch, B. (1999), p. 45.

as the sociomatrix of the complement relation for the tie from i to j where $X_{ijm}^{C} = \{X_{opq} with (i, j, m) \neq (o, p, q)\}$. This complement relation has no relational tie of type m coded from i to j. Thus, one can view this single tie as missing. In other words, the complement sociomatrices X_{ijm}^{C} give all the relational information except for the value x_{ijm} of i's tie to j.[274]

By conditioning on the complement of x_{ijm}, referred to as X_{ijm}^{C}, and consider just the probability of each network tie from i to j is present:

$$\begin{aligned} \Pr\left(x_{ijm} = 1 \middle| X_{ijm}^{c}\right) &= \frac{\Pr\left(X = x_{ijm}^{+}\right)}{\Pr\left(X = x_{ijm}^{+}\right) + \Pr\left(X = x_{ijm}^{-}\right)} \\ &= \frac{\exp\left\{\theta' z\left(x_{ijm}^{+}\right)\right\}}{\exp\left\{\theta' z\left(x_{ijm}^{+}\right)\right\} + \exp\left\{\theta' z\left(x_{ijm}^{-}\right)\right\}}. \end{aligned} \tag{12}$$

The advantage is that this alternative version of model (12) is not longer depending on the normalizing constant κ.[275]

We next consider the odds ratio of the presence of a tie from i to j to its absence, which simplifies model (12):

$$\frac{\Pr\left(x_{ijm} = 1 \middle| X_{ijm}^{C}\right)}{\Pr\left(x_{ijm} = 0 \middle| X_{ijm}^{C}\right)} = \frac{\exp\left\{\theta' z\left(x_{ijm}^{+}\right)\right\}}{\exp\left\{\theta' z\left(x_{ijm}^{-}\right)\right\}} = \exp\left\{\theta'\left[z\left(x_{ijm}^{+}\right) - z\left(x_{ijm}^{-}\right)\right]\right\} \tag{13}$$

From (13) the log odds ratio, or logit model, has the rather simple expression ϖ_{ijm} comparing the probability of one outcome of a random variable to the probability of another outcome, in a logarithmic scale:

[274] See Anderson, C. J. / Wasserman, S. / Crouch, B. (1999), pp. 42-47.

[275] Standard likelihood techniques for the Markov models are not immediately applicable because of the complicated functional dependence of the normalizing constant on the parameters (Frank, O. / Strauss, D. (1986), p. 836).

$$\varpi_{ijm} = \log\left\{\frac{\Pr\left(x_{ijm}=1\middle|X^{C}_{ijm}\right)}{\Pr\left(x_{ijm}=0\middle|X^{C}_{ijm}\right)}\right\} = \theta'\left[z\left(x^{+}_{ijm}\right) - z\left(x^{-}_{ijm}\right)\right] = \theta'\,\delta\left(x_{ijm}\right). \qquad (14)$$

The expression $\delta\left(x_{ijm}\right)$ is the vector of changes in network statistics that arises when the variable x_{ijm} changes from a 1 to a 0. This version of the model, in which a log odds ratio is equated to a linear function of the components of $\delta\left(x_{ijm}\right)$, will be referred to as the logit p* model for a single, dichotomous relation.[276] The similarity between this formulation, termed logit p*, and the logit version of the logistic regression model (8) is apparent, suggesting that logistic regression is a suitable estimation technique.

However, statistical interpretation of logistic regression models depends on the assumption that the logits are independent of one another. In the case of p*, the logits are clearly not independent. Therefore, measures such as the likelihood ratio statistic do not carry a strict statistical interpretation, but are useful as a liberal guide for evaluating model goodness-of-fit.

Given an observed network and a proposed p* model, it is naturally of interest to estimate the model parameters from the observed network. In view of the difficulty of maximum-likelihood estimation of parameters,[277] *Strauss / Ikeda (1990)* suggested an alternative pseudo-likelihood (PL) means of estimation.[278] As noted earlier, the likelihood function for the parameters θ of p* depends on the complicated normalizing constant $\kappa(\theta)$, which makes maximum likelihood estimation difficult. Pseudo-likelihood estimation is still at this time the most practicable option for the estimation of more complex models, including for large networks.[279] In this study we use pseudo-

[276] The model is easy to construct when the relation is dichotomous, so that logits are simple and well-defined. When the relation is valued, there will be N-1 logits for a dichotomous relation that takes on integer values from 0 to N-1. For a discussion at length see Pattison, P. / Wasserman, S. (1995).

[277] See Ripley, B. D. (1988); Corander, J. / Dahmström, K. / Dahmström, P. (1998); Crouch, B. / Wasserman, S. (1998); Snijders, T. A. B. (2001).

[278] A comprehensive description of the maximum-likelihood estimation is given in Andress, H.-J. / Hagenaars, J. A. / Kühnel, S. (1997), pp. 40-45.

[279] There have been recent promising developments in Monte-Carlo maximum likelihood estimation for Markov random graph models, based on algorithms for long-run simulations, but these methods have yet to be implemented for more complex models, nor in practical terms are they yet available for very large graphs (see Handcock, M. S. (2002, 2003), (2003); Snijders, T. A. B. (2002)). Although this situation is changing quite rapidly with the development of the ERGM program (Handcock, M. S. et al., 2004) and the Siena program within the StOCNET package (Snijders, T. A. B., 2002).

likelihood estimation procedure as an exploratory technique, so we do not have available accurate standard errors for parameter estimates.[280] Basically, this "pseudo-" approach assumes statistical independence of the logits ϖ_{ijm} of the conditional probabilities according to equation (14).[281]

A list of models comprising different numbers of parameters can be computed; from the simplest model comprising only one parameter the model is expanded step-by-step considering subsequent more complex parameters. The arising model goodness-of-fit statistics can be summarised in a table. Model 1 is the baseline model and reflects the null hypothesis that the probabilities of graph realizations are uniform; thus, it forms the equivalent of an intercept term in regression analysis.[282] In order to assess the fit of the model at each level we use as indicator twice the negative of the (pseudo-) log likelihood for each model.

It should be noted that as successive models fit better, twice the negative of the log likelihood, $-2L_{PL}$, a fitness value that indicates "badness-of-fit," decreases. If the difference in fit between two models of subsequent levels is small relative to the χ^2_q distribution, one can adopt the model with fewer parameters without suffering an appreciable loss of fit. If the model were to fit perfectly, the likelihood would equal one and twice the negative of the log likelihood for the model would equal zero. The badness-of-fit decreases sequentially with each level; a large value suggest poor fit. More easily, the fit can be estimated by inspecting the pseudo-likelihood ratio statistic LR_{PL},[283] defined as

$$LR_{PL} = -2\left(L_{PL,q} - L_{PL,q+1}\right) \tag{15}$$

[280] It should be noted that the parameter estimates need to be seen as approximate.

[281] For comprehensive reading see Strauss, D. (1986); Strauss, D. / Ikeda, M. (1990); Wasserman, S. / Pattison, P. (1996), pp. 416-418; for a discussion of the issues in using maximum pseudo-likelihood rather than maximum likelihood estimation, see Wasserman, S. / Pattison, P. (1996) and Preisler, H. (1993).

[282] See Chapter 3.2.

[283] The LR compares compare the fit of two logistic regression models (see chapter 3.2),

with $q = 1,2,\ldots,15$.[284]

As a means to making decisions about important parameters in the p* model we refer to a heuristic method based on the pseudo-likelihood deviance for model simplification, suggested by *Robins / Pattison / Woolcock (2004)*,[285] i.e. we infer whether certain structural components may contribute substantially to the predictive capacity of the p* model.[286] The idea is that parameters that are not important would affect model interpretation grossly if they were removed. Thus, the basis of the heuristic is to ensure that the conditional probabilities of a particular network configuration (local sub-graph) being present, as estimated form the p* model, do not vary substantially for too many cases if a parameter were to be removed.[287] However, we retain the parameter in the model, but then treat it as "unimportant", i.e. do not interpret them. Decisions are required about the level of deviations in predicted probabilities that are regarded as tolerable. For that purpose, the pseudo-likelihood ratio statistic turns out to be valuable.

A parameter is removed from the model if the resulting change of deviance $\left|LR_{PL}\right|$ is less than $-2M^{\#}\log(1-\lambda)$,[288] where λ is the acceptable level for the proportional change in predicted probabilities.[289] An acceptable level must be defined individually depending on the respective size of the network and the level of accuracy.

The model is constructed starting on the basis of the simplest local 3-sub-graph (τ_1) gradually via inclusion of more complex parameters.[290] However, as configuration contain within them various other sub-configurations, we keep the models hierarchical,

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[284] This log transformation of the likelihood functions yields a chi-squared statistic. This is the recommended test statistic to use when building a model through backward stepwise elimination (see Agresti, A. (1996)).

[285] See Robins, G. / Pattison, P. / Woolcock, J. (2004), pp. 270-272 and pp. 279 f.

[286] This approach can be used to simplify models by parameter removal (see for instance, Robins, G. L. / Pattison, P. E. / Wasserman, S. (1999), or simply to indicate the parameters that are not important to a model's predictive capacity.

[287] See Robins, G. / Pattison, P. / Woolcock, J. (2004), p. 271.

[288] In uni-modal binary networks, the number of couples is calculated as $M^{\#} = N(N-1)$, more generally termed number of cases.

[289] The smaller λ is chosen the more rigorous the criterion is in the sense that for smaller λ two models that differ by one parameter are consider „equivalent" if the difference in their pseudo-likelihood deviance is smaller. In other words, it is easier to consider a parameter "unimportant" if the λ is larger (see Robins, G. / Pattison, P. / Woolcock, J. (2004), p. 272).

[290] Configuration τ_0 , indicating null dyads, is not relevant for the purpose of this study.

so that parameters that relate to lower order configurations are retained in the model in the presence of substantial higher order parameters.

For the purpose of interpreting the empirical results of the fitted Markov random graph[291] model a number of coefficients are selected. The parameter estimate for the explanatory variable in terms of the log linear form of p* suggests, if there is a large positive value of a parameter, we follow the presence of the associated network structural component, while for a large negative value the conditional probability that it is absent is lower than the conditional probability that it is existent (ceteris paribus).

Since the explanatory variables are measured on different scales, the notion of a "large" or "small" value is not especially well-defined. Thus, in order to determine a single parameter's contribution to the overall likelihood, one can fit a smaller model without the parameter and inspect the increase in $-2L$, as previously discussed. Dually, one can interpret the parameters in terms of logit p*; i. e., as the number of a particular structural component involving the tie from actor i to actor j increases by one, and the other explanatory variables remain constant, the odds that i sends a tie to j increase by a factor of $\exp(\beta)$.

The process by which coefficients are tested for significance for inclusion or elimination from the model involves several different techniques. Besides the likelihood-ratio test that uses the ratio of the maximized value of the likelihood function for the full model over the maximized value of the likelihood function for the simpler model, see above, a Wald test is used to test the statistical significance of each coefficient β in the model. A Wald test calculates a Z statistic, which is the parameter estimate divided by the estimated asymptotic standard error of the parameter estimate.[292] This z value is then squared, yielding a Wald statistic that is distributed as a chi-squared random variable with one degree of freedom. However, several authors have identified problems with the use of the Wald statistic. It is generally agreed (e.g. *Agresti, 1990*) that this statistic can be poorly behaved when the estimate is large, thus

[291] The model is generated from the simplest network configuration.
[292] For more see Agresti, A. (1990), p. 89. With network data, these standard errors are known to be too narrow.

comparing two model likelihoods is the suggested strategy (see above). *Menard (2002)* warns that for large coefficients, standard error is inflated, lowering the Wald statistic (chi-square) value.[293] *Agresti (1996)* states that the likelihood-ratio test is more reliable for small sample sizes than the Wald test.

For the purpose of the discrete analysis ($r = 1$) on the respective partial networks in Germany, the United Kingdom and France all possible network configurations in the triad model are selected as parameters for p*. For $r = 1$ we retain 15 parameters corresponding to 15 triads in Figure 4.[294]

In summary then, we are dealing with 15 models, ranging from the simplest model containing only a parameter for dyad to the fullest model that contains all the explanatory variables described above. It should be noted, that simple network structural components are included in subsequent more complex network configurations. This can be easily seen in Figure 4. For example, all configurations higher than τ_8 includes the reciprocity parameter τ_2. The, vector of model parameters to be estimated is

$$\theta = \{\theta_i\} \text{ with } i = 1,...,7 .$$

In order to compute the vector of explanatory variables, $\delta(x_{ij})$, that consists of elements corresponding to each of the parameters, we examine each x_{ij}, for all i,j=1, 2,..., n, $i \neq j$, and compute the change in the vector of network statistics, $\mathbf{z}(\mathbf{x})$, when the tie between i and j changes from a 1 to a 0.[295]

Given equation (13) we follow

$$\delta(x_{ij}) = \left[z(x_{ij}^{+}) - z(x_{ij}^{-})\right]$$

$$= \{z_1(x_{ij}^{+}) - z_1(x_{ij}^{-}), z_2(x_{ij}^{+}) - z_2(x_{ij}^{-}), z_3(x_{ij}^{+}) - z_3(x_{ij}^{-}), z_4(x_{ij}^{+}) - z_4(x_{ij}^{-}),$$

[293] See Menard, S. (2002).
[294] For more see Chapter 2.4.
[295] Where the indicator variable δ_{ij}=1 if actors i and j are in the same position, and 0 otherwise.

$$z_5\left(x_{ij}^{+}\right) - z_5\left(x_{ij}^{-}\right), z_6\left(x_{ij}^{+}\right) - z_6\left(x_{ij}^{-}\right), z_7\left(x_{ij}^{+}\right) - z_7\left(x_{ij}^{-}\right), z_8\left(x_{ij}^{+}\right) - z_8\left(x_{ij}^{-}\right),$$

$$z_9\left(x_{ij}^{+}\right) - z_9\left(x_{ij}^{-}\right), z_{10}\left(x_{ij}^{+}\right) - z_{10}\left(x_{ij}^{-}\right), z_{11}\left(x_{ij}^{+}\right) - z_{11}\left(x_{ij}^{-}\right), z_{12}\left(x_{ij}^{+}\right) - z_{12}\left(x_{ij}^{-}\right),$$

$$z_{13}\left(x_{ij}^{+}\right) - z_{13}\left(x_{ij}^{-}\right), z_{14}\left(x_{ij}^{+}\right) - z_{14}\left(x_{ij}^{-}\right), z_{15}\left(x_{ij}^{+}\right) - z_{15}\left(x_{ij}^{-}\right)\}$$

where,[296]

$z_1(x) = \tau_1 = \sum_{i,j} X_{i,j}$ is the statistic for the arc triad parameter, θ_1,

$z_2(x) = \tau_2 = \sum_{i<j} X_{i,j} X_{j,i}$ is the statistic for the reciprocated (or mutual) dyad parameter, θ_2,

$z_3(x) = \tau_3 = \sum_{i,j,k} X_{j,i} X_{j,k}$ is the statistic for the 2-out-star parameter, θ_3,

$z_4(x) = \tau_4 = \sum_{i,j,k} X_{i,j} X_{k,j}$ is the statistic for the 2-in-star parameter, θ_4,

$z_5(x) = \tau_5 = \sum_{i,j,k} X_{i,j} X_{j,k}$ is the statistic for the 2-mixed-star parameter, θ_5,

$z_6(x) = \tau_6 = \sum X_{i,j} X_{j,k} X_{i,k}$ is the statistic for the transitive triad parameter, θ_6,

$z_7(x) = \tau_7 = \sum_{i,j,k} X_{i,j} X_{j,k} X_{k,i}$ is the statistic for the cyclic triad parameter, θ_7,

$z_8(x) = \tau_8 = \sum_{i,j,k} X_{i,j} X_{i,k} X_{k,i}$ is the statistic for the intransitive 2-out-star parameter, θ_8,

$z_9(x) = \tau_9 = \sum_{i,j,k} X_{j,i} X_{i,k} X_{k,i}$ is the statistic for the intransitive 2-in-star parameter, θ_9,

$z_{10}(x) = \tau_{10} = \sum_{i,j,k} X_{i,j} X_{j,i} X_{i,k} X_{k,i}$ is the statistic for the intransitive mutual triad parameter, θ_{10},

[296] See Wasserman, S. / Pattison, P. (1996), p. 415; Chapter 2.4, Figure 1.

$z_{11}(x) = \tau_{11} = \sum_{i,j,k} X_{i,j} X_{j,i} X_{i,k} X_{j,k}$ is the statistic for the mutual asymmetric ("U") triad parameter, θ_{11},

$z_{12}(x) = \tau_{12} = \sum_{i,j,k} X_{i,j} X_{j,i} X_{k,i} X_{k,j}$ is the statistic for the mutual asymmetric ("D") triad parameter, θ_{12},

$z_{13}(x) = \tau_{13} = \sum_{i,j,k} X_{i,j} X_{j,i} X_{i,k} X_{k,j}$ is the statistic for the mutual cyclic ("C") triad parameter, θ_{13},

$z_{14}(x) = \tau_{14} = \sum_{i,j,k} X_{i,j} X_{j,i} X_{i,k} X_{j,k} X_{k,j}$ is the statistic for the 2-mutual asymmetric triad parameter, θ_{14}, and

$z_{15}(x) = \tau_{15} = \sum_{i,j,k} X_{i,j} X_{j,i} X_{i,k} X_{k,i} X_{j,k} X_{k,j}$ is the statistic for the completely mutual triad parameter, θ_{15}.

Binary logistic regression procedures are conducted using the standard statistical software. Results are discussed in the country studies, respectively.

4 EMPIRICAL EXAMINATION

4.1 Overview

There has been plenty of work from inter-firm network scholars in last years; one reason might be that the methodological tools for analyzing overall network structures have greatly improved during the late 1990s.[297] On the other hand, changes in corporate governance (e.g. Codes of Best Practice), as well as changes in organizational structure, may have contributed to a common alteration and adaptation of the nations' interlock webs; they may have become necessary as a result of a changing global environment and increasing internationalisation of business and of financial markets. Consequently, the analysis of these structures has been central to a number of examinations of corporate networks in the major network economies in the world namely the largest economies: United States, Japan and Germany; in last years international studies including Western European countries and also Eastern European countries were released, a number of disclosure requirements regarding the object of investigation in this field have contributed to conduct those analyses.

The main challenge of cross-national analyses is to identify and conceptualize models and measurements that can be applied across borders in order to identify characteristics that are comparable, thus differences between the countries included in the comparative study can be delineated along without any distortion of measurements or model application failures. The triad-comparisons - Germany, United Kingdom, and France - here, provide an opportunity to examine how institutional interlocks used across country contexts may differ. In this regard, the triad-comparisons may lead to new observations concerning the governance network structure and the systematic of network configurations.

However, it is therefore essential to consider the institutional environment main characteristics of the individual Corporate Governance characteristics,[298] thus an intense

[297] For example: Watts, D. J. (1999); Newman, M. E. / Barabasi, A. L. / Watts, D. J. (2003).

[298] The characteristics of a CG system are numerous. Major elements can be seen in the system's orientation (see Figge, F. / Schaltegger, S. (2000), online), auditing regulations (see Pohle, K. / Werder, A. von (2002)), as well as varying structural features in organisations, i.e. management and control in enterprises (see Werder, A. von (2003), p. 17 f). For the purpose of this study, different models for management and control can be outlined to delineate the countries considered in this explorative study.

country-based research on CG and interlock networks has to be conducted first. For example, cross-ownership may have different connotations in the respective environment, and directorates may differ in their significance depending on the different national legal frameworks.[299] For an accurate interpretation of the empirical results, therefore, it is vital to take all these aspects into consideration. The key definition of Corporate Governance should be a good tool for cross-country investigations and be able to identify differences in specification of governance structure and systematic in corporate networks.[300]

The predominant network configuration is influenced in each country by its specific culture and political tradition as well by the specific institutional framework of the economy[301].[302] In consequence, international studies with a comparative perspective on the different network structures prevalent in a specified number of countries have been conducted. However, by today, less research investments have been made in the investigation of the underlying structural logic of a pre-defined governance network of a country; scholars of inter-firm networks have neglected the study of triads in favour of dyadic and other level of analysis.[303]

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[299] The pure form of the German two-tier system and the British one-tier system represent two ends of a continuum concerning possible corporate legal system which can hardly be found in practice (see Nassauer, F. (2000), p. 267; Breuer, R.-E. (2001), p. 20). In France, firms may have the option between two forms of CG systems: the one-tier model with a single board similar to the British system and the two-tier system which has a similar form to the German model composed of two separate organs, the board of directors and the supervisory board (Articles 89 ff of the Loi sur les sociétés commerciales regarding the one-tier model, article 118f ff with regard to the two-tier system).

[300] Depending on the value system prevailing in a particular country or context, CG has been seen to deal with different issues. In research as well as in practice, it is common to distinguish between two basic models of CG which can be found in a variety of forms: the Anglo-American 'market-centred' model which emphasizes the maximization of shareholder value and the Continental European 'relationship-based' or 'bank-centred' model which emphasizes the interests of a broader group of stakeholders (see La Porta, R. / Lopez-de-Silanes, F. / Shleifer, A. (1999); Hall, P. / Soskice, D. (2001); Streeck, W. (2001)). Hilb (2005) has made an attempt to integrate the strengths of both approaches creating a third way proposing a "glocal, both-and" approach, adopting both the global relevance of aspects of the Anglo-American board best-practice, and the local governance best-practices evident in the approaches adopted by multinationals (see Hilb, M. (2005), p. viii).

[301] Examples of economic institutions include corporate law or the 'social structure of the market' (see Fligstein, N. (1996), p. 657).

[302] *Davis / North (1971)* define the institutional framework in which markets are embedded as a 'set of fundamental political, social and legal ground rules that make up the economic environment (see Davis, L. / North, D. (1971), p. 6).

[303] See Madhavan, R. / Gnaywali, D. R. / He, J. (2004), p. 926.

This paper aims to demonstrate the state of the triadic microstructure of corporate interlock networks predominant in Germany, the United Kingdom and France as of the end of the year 2004. Each country study is concerned with the overall patterns of relationships between corporations that result from interlocking corporate directorates and equity ownership in the three major European economies cited above. The research reported in the country studies has its origins in the inter-organizational perspective.[304] The network data included in this study will allow us to address this issue.

A comparison of the empirical results might reveal conclusions regarding the corporate behaviour and corporate strategy of the actors that form part of the sample defined for each nation given the main characteristics[305] of the respective corporate governance system.[306] These results gain importance given a changing corporate market as a result of an intensified competition within the ongoing process of globalisation. Thus, a comprehensive analysis of the systematic of these network economies is an essential contribution to research, given also the fact of the rising power of inter-organizational networks in globalizing markets.

Interlocks may be regarded as signs of possible power relations;[307] thus, the description of network structures and the analysis of the underlying logic of governance systematic in these economies demonstrates the distribution of economic power[308] in the

[304] Level of analysis: interlock system. Units of analysis: enterprise.

[305] Whereas the Anglo-Saxon model is characterized by large and capital markets and an active market for corporate control, the Continental European model can be described as a network-oriented system, where large corporate groupings are in an intricate structure of cross-shareholdings (see Block, T. H. (1998), p. 1 f). Comparisons of CG system have highlighted particularly that these two models mainly differ in the way firms are financed and controlled (see David, T. / Mach, A. (2003), p. 221). Whereas in Continental European countries traditionally banks tightly linked to industrial enterprises in often two ways, as shareholders and creditors, in the United Kingdom institutional investors dominate holdings in industrial companies (see Walter, I. (2000), pp. 114-116). This classification of CG into bank- and market-centred models is not the only distinctive factor of their mechanisms. Another element which distinguishes Anglo-Saxon countries from Continental Europe lies in the ownership structure of the enterprises: in general, concentration of ownership is much higher in Continental Europe than in the UK (see La Porta, R. / Lopez-de-Silanes, F. / Shleifer, A. (1999), p. 471 ff; Becht, M. / Barca, M. (2001)). Given these criteria, Germany clearly belongs to the bank-centred model whereas the UK to the Anglo-Saxon. France cannot be clearly assigned to any of the two.

[306] Key characteristic for demarcation is the separation of power regarding the various bodies, i.e. how is management and control of the enterprise formally separated.

[307] For 'power structure' research see, in particular, Domhoff, G. W. (1980).

[308] On an inter-organizational perspective, relations between enterprises are seen as constitutive of the environment within which they are located and therefore as determinants of their possibilities of action (for different perspectives on economic power see Stokman, F. N. / Ziegler, R. / Scott, J. (1985), pp. 3-5).

national corporate landscape[309] and demonstrates the distributional structure of social capital[310] (in the sense of the potential to mobilize the resources of another person in order to pursue one's own interest). Accordingly, the architecture of social networks is important because it shapes organizational behaviour; changes in the structure of the network should have important consequences for the strategies adopted by organizations.[311] However, networks among financial, commercial, and industrial firms determine significant features of that economy's overall organization and its resulting performance.[312] The goal of the single country studies and the comparative study is to test the hypotheses set up in Chapter 1.3.1 concerning the systematic of the prevalent interlock network by analysing its connective topography at their current state by end of 2004. Moreover, the comparative study scrutinizes the hypothesis that differences in the companies' triadic microstructure for the respective economies does exist. Apart from national variations in interlocking, each of the partial networks - defined by the two types of corporate interlocks - has their own distinct structures. Only through a study of such partial networks is it possible to assess the aggregation of interlocks that evaluate the corporate network in each national economy.

Chapter 4 is divided into four sections: following this introduction to the empirical examination, first, three separate country studies are conducted: Germany (**Chapter 4.2**), France (**Chapter 4.3**) and United Kingdom (**Chapter 4.4**). The individual country studies are held equivalent in terms of their structure: first a demarcation of the sample is provided and thus the borders of the respective national corporate networks are set (nominalistic approach). Given the different legal structures and form in the organisations regulated by corporate law in the three economies the two different forms of corporate ties that are considered in the empirical examination – interlocking directorships and ownership ties – are defined (object of investigation). Next, an empirical mapping of patterns of social relations between large enterprises establishing the social structure of the governance network in Germany, France and the U.K. is

[309] Interlock research allows easily drawn conclusions about the concentration of (economic) power within the particular corporate landscape.
[310] Comprehensive literature is available on this subject, e.g. Burt, R. S. (2000).
[311] See Davis, G. F. / Yoo, M. / Baker, E. W. (2003), p. 302.
[312] See Gerlach, M. L. / Lincoln, J. R. (1992), p. 491.

presented on a descriptive level taking advantage of the social network perspective[313] in analysing their structures based on the empirical data.[314] For the purpose of the description of the network structure we made a selection on a number of structural coefficients that could be found in other research studies in this field that gives a broad overview of the network very shortly considering the given extent of this section.

Thereafter, the underlying structural logic of the network systematic is investigated. The occurrence of possible configurations in the network architecture[315] is examined employing a quantitative probability model. A discrete, uni-variate analysis for each partial network in the respective network economy is conducted. The results from this analysis are interpreted successively addressing the hypotheses about the governance systematic that were drawn up at the very beginning of this study.

[313] The network perspective is flexible in its applicability to different kinds of actors and to different kinds of relations (for more see Contractor, N. / Wasserman, S. / Faust, K. (2003), p. 3). The social network approach to organizations is entirely fitting, since, as O'Reilly (1991) observes, "Organizations are fundamentally relational entities" (see O'Reilly, C. A. (1991), p. 446).

[314] The social network perspective views characteristics of the social units as arising out of structural or relational processes or focuses on properties of the relational systems themselves (see Wasserman, S. / Faust, K. (1999), p. 8).

[315] As described on the theoretical level in Chapter 2.4 of this study.

4.2 Country Study: Germany

The German corporate governance structure is characterised by historically grown, interweaving and interlocking corporate relations between large companies,[316] establishing a complex network, a cartel-like organizational form that is better known as "Deutschland AG" (*Adams, 1999*).[317] One of the central characteristic features of German corporate governance is the dense and centralized corporate network incorporating virtually all large public business corporations listed in Germany.[318] A complex network of control emanates as a result of a number of corporate ties of various types such as interlocking directorates and ownership ties by which firms are linked to each other. According to *Ziegler (1984)* the German governance network consisting of interlocks and capital linkages is multi-causal and multifunctional.[319]

Moreover, the system is characterized by a dominating role of the banks, a system of close relationships among firms and similarly close relationships between firms and universal banks.[320] Large firms tend to have more concentrated ownership, greater reliance may be placed on long-term debt, and equity markets are thinner. Lending tends to be intertwined with equity ownership, with loan providers often having substantial equity stakes.[321] Ownership in Germany is highly concentrated[322] and a conglomerate of banks, major shareholders and long-term inter-company relationships are dedicated to control the management.[323] Under these conditions, monitoring and control take more of an insider or direct form and are often achieved via board representation of major suppliers of capital.[324] The external market for corporate control is classified as relatively weak in comparison to the United Kingdom and France,[325] and relationships between financiers and managers can be built around long-term mutual

[316] See Heinze, T. (2001), p. 641.
[317] Corporate rights of disposal in Germany are coordinated by a network of interlocking directorates and capital ties rather than a market for corporate control (see Heinze, T. (2002), p. 391).
[318] See Windolf, P. (2002), p. 212; Franks, J. / Mayer, C. (1995), pp. 176-177; Windolf, P. / Nollert, M. (2001), pp. 54-56.
[319] See Ziegler, x. (1984), p. 586.
[320] See Witt, P. (2003), p. 90; Fohlin, C. (2004).
[321] See Gospel, H. / Pendleton, A. (2003), p. 563.
[322] See Shleifer, A. / Vishny, R. W. (1996), pp. 49 ff.
[323] See Kaplan, S. N. (1996), p. 301 f.; see Leyens, P. C. (2003), p. 66.
[324] See Gospel, H. / Pendleton, A. (2003), p. 563.
[325] See Kaplan, S. N. (1996), p. 302; see Charkham, J. P. (1995), p. 351.

commitments. Stock market capitalization of domestic firms is relatively small given a relatively small number of publicly listed firms in Germany.[326] The largest group of shareholders in German firms is the corporate sector;[327] banks are also substantial holders of equity, thus, as stated above, play an important role in governance.[328] Moreover, in many cases, a firm holding equity of a particular other entity, parallel delegates a representative manager onto the corporate management of this organisation. By this mechanism, the structure of control within the 'Deutschland AG' *(Adams, 1999)*, a popular label for the existing corporate network in Germany, becomes more complex and less transparent.[329] The German CG system, therefore, is commonly referred to as a relational and insider-oriented system.[330]

The well-established, historically built system of interlocks in the German corporate landscape is affected to a large extent by the importance of outside capital finance instrument comparing to other countries,[331] equity ownership is relatively highly concentrated on both banks and non-financials, additional power of banks through accumulated voting, the absence of an effective regulation of public take-overs as well as numerous ways to manipulate voting rights, as for example, multiple voting rights, which may prevent the transfer of rights of disposal onto the stock markets.[332] All these factors lead together for the setting up of mutual financial and personnel interlocking motives.

Throughout the study we refer to existent empirical results of network-analytic investigations of the German governance network found in literature, among others, for example, *Ziegler (1984)*, *Pappi / Kappelhoff / Melbeck (1987)*, *Pfannschmidt (1993, 1995), Schreyögg / Papenheim-Tockhorn (1994, 1995), Windolf / Beyer (1995)*, *Beyer*

[326] See Mann, A. (2003), p. 132 f.
[327] See Franks, J. / Mayer, C. (1997), p. 283.
[328] See Prowse, S. (1994), p. 27.
[329] The network of interlocks is largely invisible to anyone who doesn't have the time and experience to read and cross-reference regulatory filings.
[330] CG systems are commonly distinguished between "insider"- and "outsider"-systems (for a detailed demarcation see Gaved, M. (1998), p. 7)
[331] If the debt proportion is relatively high, as is usually the case in Germany, then the interests of stakeholder groups, other than the shareholders interests are central. If the equity proportion is high as is usually the case in the USA or the UK, then the shareholders interests are more central (see Aguilera, R. V. / Jackson, G. (2003), p. 450 f).
[332] See Adams, M. (1994), p. 151; Franks, J. / Mayer, C. (2001), pp. 950-952; Wójcik, D. (2003), pp. 1433-1435.

(1996, 2002), *Windolf (1997)*, *Windolf / Nollert (2001)*, *Heinze (2001, 2002, 2003)*, and *Höpner / Krempel (2003)*, *Wójcik (2003)*, *Rank (2003; 2005).*

4.2.1 Sample and Data

The dataset captures the largest public stock corporations (=N^G), ranked by market capitalisation listed in the German Prime Standard[333] segment in the composition as of end of year 2004 (reporting date January 1, 2005).[334] The 2004 sampling frame included 350 corporations stock listed in the Prime All Share-Index[335].

A descriptive analysis of the German corporate network structure is carried out using the methodology of social network analysis; subject of analysis are interlocks between firms that form part of the sample (particularly the interlocking directorates and shareholder-crossings). Coefficients for the descriptive analysis were computed for the total sample of 350 firms; we explored our hypothesis using data on networks consisting of 162 firms that had entered into the directorship network, and 56 firms with regard to the ownership network.

For the purposes of this country study, data on board directorships was collected from the Annual Reports of the sampled firms for the year 2004 (as of 31.12.) restricted to directive directorships[336].[337] A managing director is defined as being a member of the board including the Chairman, or the Chairman of the supervisory board that is sent onto the supervisory board of another firm.[338] For example: Dr. Gerhard Cromme holds

[333] Each company listed at the Frankfurt Stock Exchange may apply for a listing either in the General Standard or in the Prime Standard Segment. In order to be listed in the latter, issuers will have to maintain higher transparency standards subsequent to admission. The selection indices of Deutsche Börse are also restricted to shares that are listed in the Prime Standard segment. Deutsche Börse performs the calculation of sector indices in a standardised manner and exclusively for the Prime Standard segment with 18 Prime sectors and 62 industry groups representing the first and second tier. Admission to Prime Standard requires certain publication standards and fulfilment of the resulting international transparency requirements (see Deutsche Börse (2005).

[334] Throughout the study, the term 'company' or 'firm' is employed, always referring to a member of the Prime All Share-Index.

[335] See Deutsche Börse AG (2004), online.

[336] Indirect interlocks emerge when two representatives of different corporations sit on the board of a third firm and thus have face-to-face interaction on a regular basis.

[337] In some cases we collected the information from the annual report of the respective group company; in some cases we contacted the investor relations responsibilities of the respective company.

[338] The German corporate legal system is characterised by the assignment of management and management control tasks to two different organizational entities in the German "Aktiengesellschaft": management board ("Vorstand") and supervisory board ("Aufsichtsrat") (see Lutter, M. (1995), p. 6).

the Chair of the supervisory board at ThyssenKrupp AG and at the same time is sitting onto the supervisory board of Allianz AG; Dr. Stefan Jentzsch is a board member at HypoVereinsbank AG and holds a directorship on the supervisory board of Deutsche Börse AG.

Managers can be a member of the board of one firm and, at the same time, hold a mandate in the supervisory board of another firm, thereby creating a network of directorates.[339] But due to legal restriction,[340] members of the supervisory board cannot be a member of the management board at the same time within one firm. It should be noted that the total number of directorships is exceedingly higher taking also linkages between ordinary members of the supervisory board into account.[341]

When companies hold ownership on other companies, networks develop that are called capital networks. Data on ownership ties came from the database "Major Holdings of Voting Rights in Offically Listed Companies" provided by the German Federal Financial Supervisory Authority (BaFin), and is restricted to direct ownerships.[342] The BaFin has drawn up a consolidated overview of the holdings of voting rights in German companies listed on the first segment of the German stock exchanges (Amtlicher Handel). On the basis of the publication requirements set out in Sections 21 ff. of the Securities Trading Act (WpHG), the database contains those voting rights which are held by the notifying party due to ownership of the shares thus provides the exact figures about the shareholder structure of exchange-listed companies.[343]

[339] See Windolf, P. (1994), p. 82.
[340] German corporate law does not allow executive managers to sit on the supervisory board of their own company (diagonals in the matrix are excluded), in accordance with article 105 (1) of the German Stock Companies Act (AktG).
[341] For the purpose of this study we follow the governance perspective; thus these linkages are not relevant.
[342] For the purposes of this study, an indirect investment is an equity investment of one firm held through a third party.
[343] At http://www.bafin.de/database/stimmrechte.htm, online.

However, it should be noted that the full extent of cross-holdings in Germany is not publicly known, as cross-holdings are frequently subdivided so that they remain below the threshold levels that would imply mandatory publication.[344]

A detailed overview of the interlocking ties between the members of the sample defined in accordance with the definitions set out here is shown in the Appendix.

4.2.2 Descriptive Statistics

For the target year 2004 the total number of directive interlocking directorships between members of the Prime All Share Index amounts 612,[345] the number of multiple interlocks[346] in total amounts eight, whereby half of the cases were identified where a pair of actors is linked by two directorships, in half of the cases the pair of actors are triple-linked. In other words, 8.642 percent of the connected companies share two or more directors.[347] A network density of $\Delta p = 0.501\%$ meant that 612 out of the 122,150 possible links among corporate actors[348] were present in the personal network.[349] The network density taking only linked firms into our calculation amounts $\Delta p^{l} = 2.346\%$,[350] with a total number of isolated firms' in the Prime All Share of 188.[351] Taking multiple directorships into calculation,[352] a density of $\Delta p^{d} = 0.491\%$ is computed.

An investigation of the structure of interlocks on the individual actor level allows drawing conclusions on the degree of embeddedness of individuals (*Granovetter, 1985*).[353] The maximum outdegree observed among firms amounts 15 in the personal

[344] Public business corporations need to declare holdings above the threshold of five percent (in accordance with article 21(1) German Securities Trade Act (WpHG) and article 285(11) German Trade Act (HGB)).
[345] See Table 1: Row 2.
[346] Multiple relations play an important role of internal control model in organisations since end of the 19th century (see Windolf, P. / Nollert, M. (2001), p. 59).
[347] See Table 1: Row 2 and 3.
[348] The maximum number of possible relations between actors within the defined network comprising of 350 actors is 122.150 ($= M^{\#,G}$). This is true for both personal and capital network. One firm could hold share capital of itself; however, this is not studied in this paper
[349] See Table 1: Row 8.
[350] See Table 1: Row 9.
[351] See Table 1: Row 4.
[352] Sociometric data dichotomised.
[353] Following the analysis of Windolf, P. / Beyer, J. (1995), p. 11.

network, the maximum indegree amounts 8; the median degree amounts 0.874.[354] All in all, a relatively broad integration of enterprises in the network is existent with a medium degree of concentration of power; the latter is supported by a comparably high degree-based network centralisation.

The number of cross-shareholdings between companies that form part of the dataset amounts 86.[355] A low degree of participation measured by the median degree of centrality is also reflected in a low density of the partial network, which amounts to $\Delta p = 0.070$. Without considering firms those remain unlinked to the capital network $\Delta p^{l} = 2.792\%$;[356] the number of isolated firms observed amounts 294.[357] A relatively low degree-based network centralisation together with a small number of linked firms supports the argument of a high degree of centralisation of power within the Prime-All-Share ownership network.

The principal findings regarding the structural features on the personal network and capital network are summarized in **Table 1**.

[354] See Table 1: Row 7. Note that median outdegree=median indegree, as for simple graphs indegree=outdegree=total degree / 2 (see Freeman, L.C. (1979)).
[355] See Table 1: Row 2.
[356] See Table 1: Row 8 and Row 9.
[357] See Table 1: Row 4.

		Germany					
		Directorship Network			Ownership Network		
1	Number of firms that form part of the sample (=N^G)	350					
2	Number of interlock ties ($M^{G,P}$; $M^{G,C}$)	612			86		
3	Number of multiple interlocks[358] / direct corporate interlocks	8		600			
4	Number of Isolates / Linked firms (in % of N^G)	188 (53.71)		162 (46.29)	294 (16.00)		56 (84.00)
5	Number of Sender / Receiver / Intermediaries	116	133	86	25	38	7
6	Degree-based network centralisation	0.001719			0.000164		
7	Centrality degree						
	- outdegree (Max. ($O^{G,P*}$; $O^{G,C*}$)/ Med. / StDev.)	15	0.874	1.914	5	0.123	0.561
	- indegree (Max. / Med. / StDev.)	8	0.874	1.576	3	0.123	0.377
8	Network density (overall) in %	0.501			0.070		
9	Network density (without unlinked firms) in %	2.346			2.792		

Table 1: Structural Features of the Governance Network (G)

Note: Relative numbers are in parentheses.
Source: Own calculations based on empirical network data.

Based on the descriptive figures in Table 1 we conclude on a large-scale integration for the personal network whereas a low concentration of power dependence is observed for the capital network. The concentration of power in the interlock network can be examined more comprehensively analysing the centrality degree of its actors.[359]

Describing the configuration of the network adjoined to the core-periphery-model[360], we could draw some conclusions on the appearance of the partial networks. Looking at the structure of the reciprocal cooptation, a number of entities are relatively highly embedded. For the purpose of the particular sample, for the personal network firms are defined as being a member of the network core if the sum of their respective indegree and outdegree amounts higher than eight.[361] Given this assumption, we can identify a

[358] Relevant only for the directorship network.
[359] See Freeman, L. C. (1998), p. 109 ff.
[360] The core-periphery model compares actual network architecture with the help of an iterative procedure with ideal-typical core-periphery structures, in which the core participants are fully connected with one another, the peripherical actors - in contrast - remain unconnected among themselves (see Borgatti, S. P. / Everett, M. G. (1999), p. 375 ff). A graph has a core-periphery structure to the extent that it lacks subgroups, i.e. all actors can be regarded as belonging (to a greater or lesser extent) to a single group, either as core members or peripheral members (see Everett, M. G. / Borgatti, S. P. (2005), p. 68).
[361] The approach taken here does not follow the work of Borgatti / Everett (1999) in the case that we used a rather intuitive way of individually setting the core members as a set of actors that are significantly higher embedded within the network measured by the individual actors' sum of in- and outdegree. In contrast, Borgatti / Everett (1999) simply partitioned the actors into core and periphery classes by the criteria that the core is a complete subgraph and the periphery is a collection of actors that do not interact with each other.

group comprising of 28 corporate actors forming the core of the network. The degree-centrality of these firms amounts relatively higher than all others (on average). With regard to the outdegree, the figure calculated on the members of the network core amounts to 0.017. In other words, 5.9 representatives are delegated onto the supervisory boards of other Prime-All-Share members. With regard to the indegree, this coefficient amounts 0.014; in other words, 5.0 seats on the supervisory board of the respective firm are held by other members. With regard to all actors within the defined network the figures are 0.003 (0.9 managers).[362]

Remember the number of figures on isolates, receivers and senders, central actors and actors that could be assigned to the periphery of the network: we can conclude on a relatively broad centre, the ratio of central actors to periphery amounts 0.209 for the directorship network. This is underpinned by the analysis of the directorship network regarding its degree-based centrality. The centralization degree of the network[363], from which statements on the intensity of the actors' degree can be derived, amounts 0.001719.

For the ownership network a relatively small centre could be identified, the number of core components amounts four, whereby the critical value is set on five and more. The ratio central actors to periphery amounts 4:52, the degree-centrality of the central actors amounts 0.004:0.013 for the indegree:outdegree ratio, which is, on average, significantly higher than for all network actors. Interestingly, these four central actors hold financial stakes on others in 18 cases, whereas in five cases others hold ownership stakes in this group. The degree of network centralisation - allowing statements on the degree of 'embeddedness' (*Granovetter, 1985*) of the individual actor - provides evidence for this statement. The maximum outdegree observed among firms is relatively high, whereas the maximum indegree is relatively low; the median degree is on a low level. But, indeed, no conclusions can be drawn on a large-scale integration; in fact, a relatively high concentration of power dependence is observed examining the individual centrality degree of its actors.

[362] For simple graphs indegree=outdegree=total degree / 2.

[363] A centralization measure quantifies the range of variability of the individual actor indices (see Wasserman, S. / Faust, K. (1994), p. 180). The degree of network centralization was computed according to Freeman's (1979) group degree centralization measure.

The network of directorships and the ownership network are illustrated by a sociograph in **Figure 2** and **Figure 3**. For the purpose of the visualisation of the large network comprising of 350 actors in both partial networks only the linked firms are considered in the figure, i.e. we dropped non-linked firms from the graphs. However, it becomes obvious, that the web of relationships becomes relatively complex depending on the number of actors included.

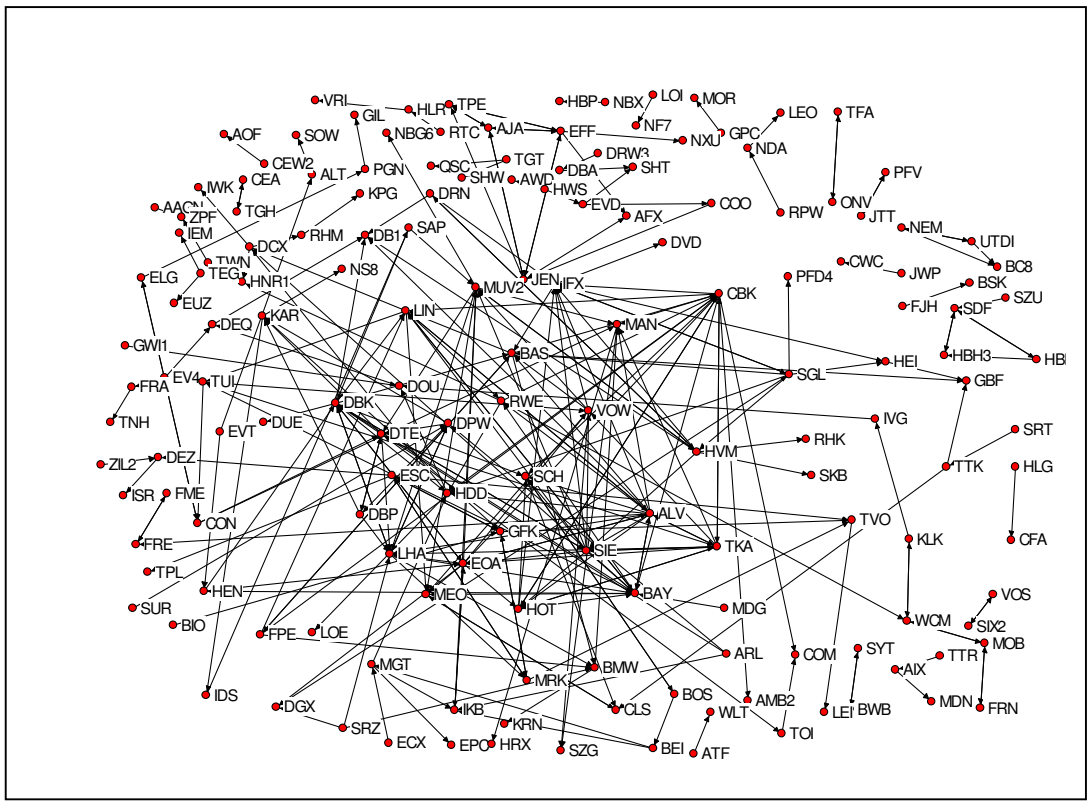

Figure 2: Sociograph for the Personal Network (G).

Note: Illustration without isolated actors; firms labelled with their respective ticker symbol.

Source: Sociograph developed with NetDraw [364], Version 2.17, based on surveyed network data (dichotomized).

[364] NetDraw is a program for drawing social networks. NetDraw is free and may be freely distributed. For more information about the program, contact its author, Steve Borgatti, at steve@analytictech.com or +1 978 456 7372.

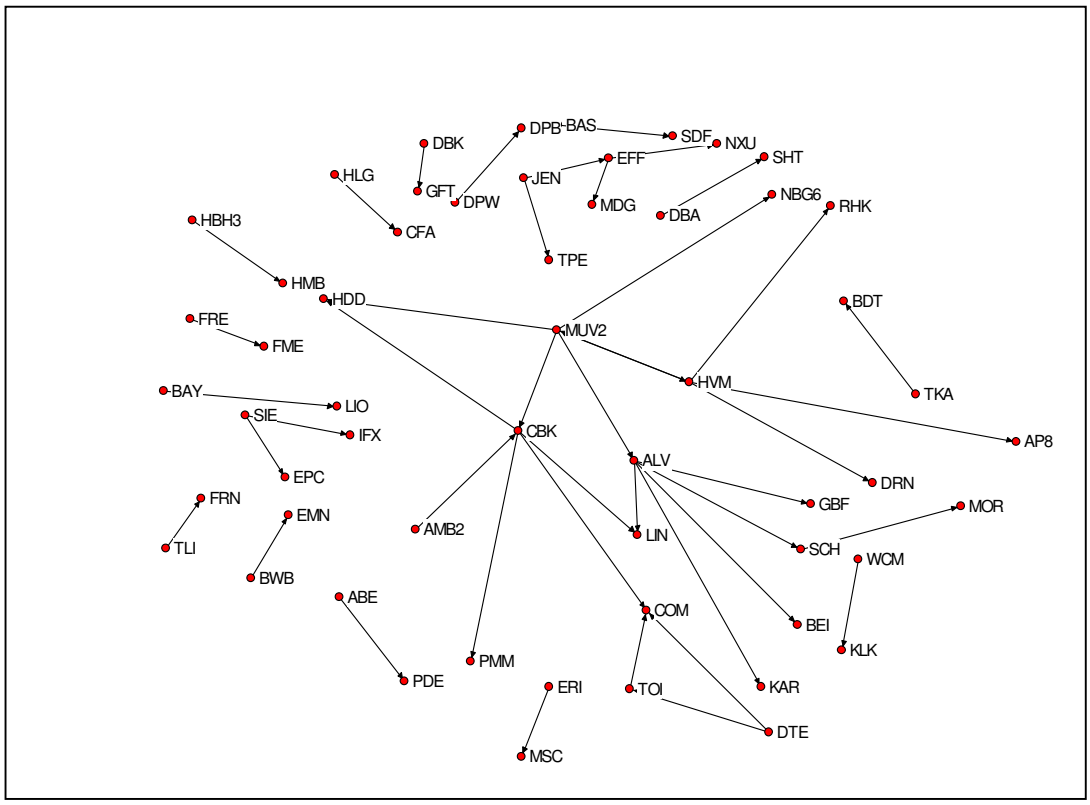

Figure 3: Sociograph for the Ownership Network (G).

Note: Illustration without isolated actors; firms labelled with their respective ticker symbol.

Source: Sociograph developed with NetDraw [365], Version 2.17, based on surveyed network data (dichotomized).

Conducting an analysis on the individual corporate level, we extracted information on the distribution of directorships. **Figure 4** demonstrates the concentration of mandates held by firms that could be assigned to the German sample. From the figure it becomes evident, that the number of seats held by firms is distributed as expected with less companies the higher the number of directorships held per company. Interestingly, approximately two third of the actors are not embedded in the German network at all, 43.97 percent of the remainder is linked by only one mandate. However, from Figure 4 we have seen that also isolated social circles are existent in the German personal network. Altogether, the argument can be supported that the mandates in the network

[365] NetDraw is a program for drawing social networks. NetDraw is free and may be freely distributed. For more information about the program, contact its author, Steve Borgatti, at steve@analytictech.com or +1 978 456 7372.

are highly concentrated on a small number of actors; a proportion of nearly 11 percent of the total number of actors holds 4 or more mandates.

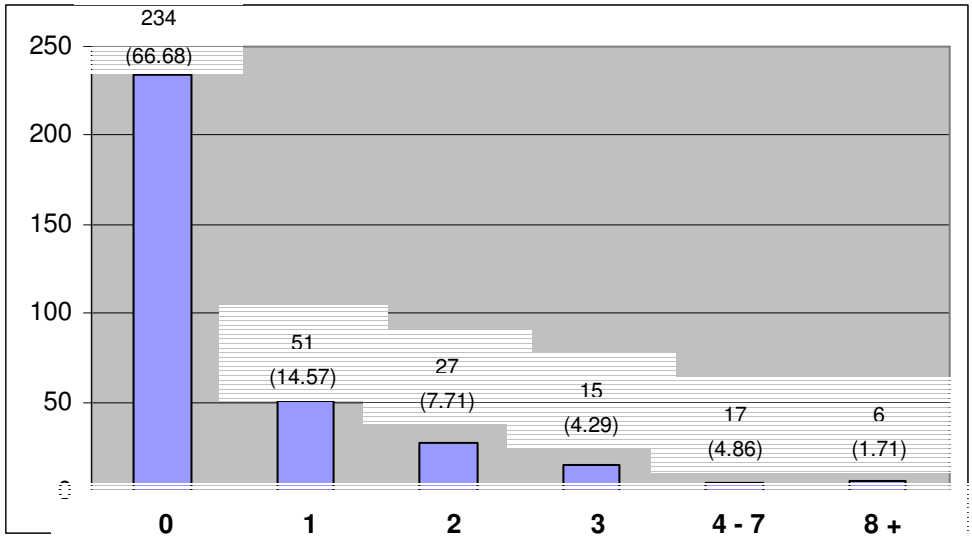

Figure 4: Distribution of Directorships per Actor (measure: outdegree) (G).

Note: Relative numbers are in parentheses.
Source: Based on empirical network data.

In order to evaluate how enterprises are embedded into the network, actors' analysis regarding their particular function playing in the governance network is conducted.[366] In the present sample, the Prime Standard Sector network of listed companies at the German Stock Exchange, 116 actors are identified as senders, 133 as receivers, and 86 are embedded in the directorship network as intermediaries.[367] We suggest a relatively low degree of integration based upon the small number of intermediaries and the large number of isolates within the network of directorship. From the sender-receiver ratio no clear tendency for the network governance can be concluded.

Examining the ownership concentration, we could derive statements regarding the strengths of potential influence and control of owners in the capital network. **Figure 5**

[366] In network theory, players are distinguished according to their function as a net sender, a receiver, or as an intermediary.

[367] Each actor can be classified to one or more of these categories. In this context, senders are firms where the outdegree is positive, given the indegree equals nil. Actors that have a positive indegree given an outdegree of nil are classified as receivers. Intermediaries are those with an outdegree and indegree other than nil. Isolates are enterprises not linked at all to any of the actors assigned to the defined sample.

demonstrates the distribution of share ownership concentration.[368] From the figure it becomes evident that stakes are distributed unequally with regard to the classification we have defined. Accordingly, we found a highly concentrated ownership for stakes between five and 9.9 percentages. Interestingly, a relatively high number of ownership ties exceeding the veto threshold of 25 percent is observed.

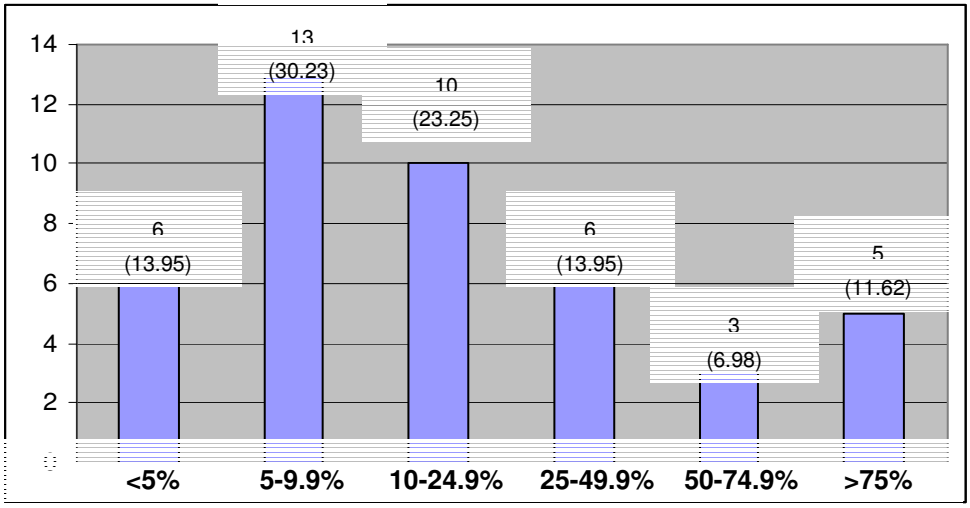

Figure 5: Degree of Ownership Concentration (Proportion of Stock Owned in %) (G).

Note: Measure is the outdegree. Relative numbers are in parentheses.
Source: Based on empirical network data.

Another form of visualization of the structure of cross-shareholdings is shown in **Figure 6**. From the results, a high concentration of dominant cross-shareholdings on a small number of corporations can be concluded. A large number of firms are identified that do not hold investments on other members. The numbers of corporations held by multiple owners amounts 4, the number of companies who holds multiple linkages within the network amounts twice as much. Figure 6 depicts the different role of actors playing in the ownership network according common classification in network theory regarding actors' function.

[368] For the purpose of this study data on major holdings of voting rights held by the party due to ownership of shares are collected; thus provides a picture of the shareholder structure of the respective companies.

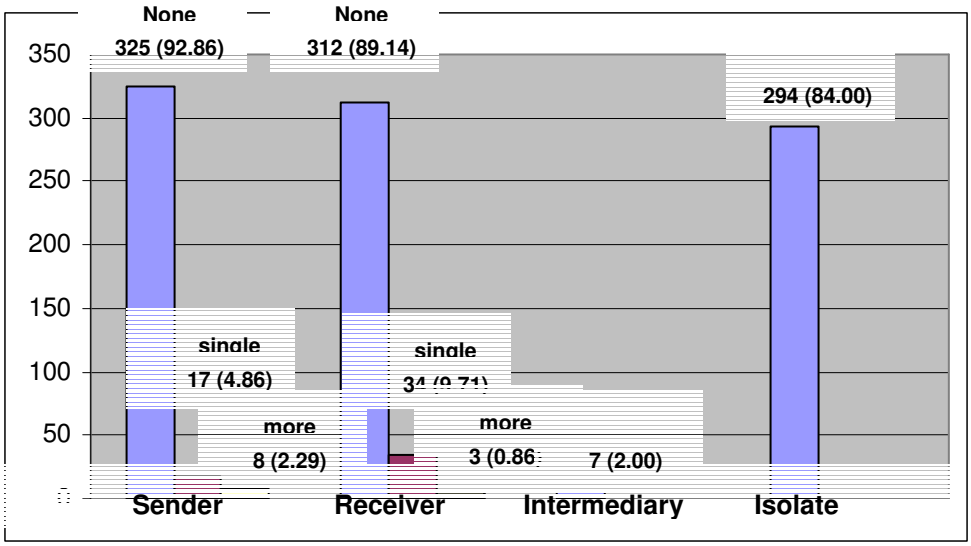

Figure 6: Structure of Cross-Shareholdings (G).

Note: Measure is the outdegree. Relative numbers are in parentheses.
Sender: no participation (none), one participation (single), more than one participation (more);
Receiver: no owner (none), one owner (single), more than one owner (more).
Source: Own calculations based on empirical data.

From a total network perspective some degree of overlap between the two partial networks can be assumed. For the Prime-All-Share network 14 enterprises are identified who own interlocks of both types, in total 21 cases are observed. Interestingly, in the major part of the cases managers are sent to companies where a major stake is held. Thus, we can suggest that a large ownership stake comes along with a willingness to be present in the governance body of the respective firm. The empirical results of *Windolf / Beyer (1995)*, thereby, can be confirmed,[369] however, in our study, a lower degree of overlap can be stated. Another argument suggested by the same authors, stating that from a financial stake of more than 10 percent parallel directorships truly emerge,[370] can also be confirmed with respect to our sample study.

Statements from the descriptive analysis with regard to the governance network structure are limited in information, especially with regard to position and power of actors within the respective network. An additional examination of the underlying structural logic of the predefined networks focusing on dyadic and triadic relations

[369] Windolf/Beyer (1995) provided evidence for substantial overlap of the two partial networks for Germany (see Windolf, P. / Beyer, J. (1995), p. 18).
[370] See Windolf, P. / Beyer, J. (1995), p. 18.

between actors might reveal more useful findings. A discussion around the empirical results of a discrete, uni-variate analysis regarding the triadic microstructure in both partial networks described here will be presented in the following chapter.

4.2.3 Empirical Results

The discussion of p* that follows center around the German directorship network and the German ownership network formed by the 350 members that can be assigned to our pre-defined dataset, the Prime-All Share Index, consisting of 162 and respectively 56 linked firms, whose directed graph appears in Figure 5 and Figure 6, respectively.

Overall, $\binom{350}{3}$ triads are possible in each network, $\binom{162}{3}$=695,520 and $\binom{56}{3}$=27,720 nonnull triads for the particular partial network: $\Im = \{T_{1,2,3}, T_{1,2,4}, \ldots, T_{160,161,162}\}$ and $\Im = \{T_{1,2,3}, T_{1,2,4} \ldots, T_{54,55,56}\}$, respectively. **Table 2** presents counts of the various relevant types of triads from the triad census. The examination of the counts contained in the triad census[371] might help the researcher determine whether any of the structural properties are present at the network level, and if so, to what degree.[372] Thus, the triad census is a convenient way to reduce the entire sociomatrix X to a smaller set of, in this case, sixteen summary statistics. The larger n is, the more of a reduction that occurs, i.e. by this means a substantial condensation of the information in X is achieved. *Wasserman / Faust (1994)* argue that "the triad census is one of a number of digraph properties that should be included in a thorough network analysis since it captures and then summarizes several important structural properties in a parsimonious way."[373]

[371] The triad census does not condense the original data as much as dyad census, since it has 15 components rather than just three. Therefore, there is considerably more that we can learn from triad census (see Wasserman, S. / Faust, K. (1994), p. 557. For methods for calculating the triad census see Moody, J. (1998), p. 291 ff.
[372] See Wasserman, S. / Faust, K. (1994), p. 557.
[373] See Wasserman, S. / Faust, K. (1994), p. 569

		Triad Census	
No. of Arcs	Network Configuration	Directorship Network	Ownership Network
0	τ_0	656.597	25.509
1	τ_1	31.434	2.109
2	τ_2 ; τ_3 ; τ_4 ; τ_5	6,359 ; 151 ; 249 ; 364	47 ; 4 ; 27 ; 15
3	τ_6 ; τ_7 ; τ_8 ; τ_9	34 ; 5 ; 149 ; 95	2 ; 0 ; 7 ; 0
4	τ_{10} ; τ_{11} ; τ_{12} ; τ_{13}	15 ; 35 ; 7 ; 12	0 ; 0 ; 0 ; 0
5	τ_{14}	9	15
6	τ_{15}	5	0

Table 2: Triad Census (G).
Note: The sixteen types of triples are presented in the no. of arcs present.
Source: Pajek[374]-report reading network data.

The high number of null triads (sets of three firms with no ties among them) shows that the overall network is rather sparse. On the other hand, there are, in total 38,923 triads for the directorship network and 2,226 for the ownership network, respectively, among the remaining non-null triads, thus suggesting some triadic behaviour in the Prime-All-Share network with respect to both forms of institutional linkages. This assumption is apparently supported by the sociograms in Figure 5 and Figure 6 and the descriptive measures from Chapter 4.1.2.

The p* results for the uni-variate analysis are presented next. **Table 3** shows the goodness-of-fit measures for the p* model, respectively for the directorship and ownership network.

[374] A program developed by Vladimir Batagelj (Department of Mathematics, FMF, University of Ljubljana, Slovenia) and Andrej Mrvar (Faculty of Social Sciences, University of Ljubljana, Slovenia) for (non-statistical) analysis and visualization of large networks. The latest version of Pajek is freely available, for non-commercial use, at its homepage: http://vlado.fmf.uni-lj.si/pub/networks/pajek.

	Goodness-of-Fit for p* Model			
	Directorship Network		Ownership Network	
Model (=No. Parameters included)	$-2L_{PL}$	$-LR_{PL}$	$-2L_{PL}$	$-LR_{PL}$
1 (τ_1)	2.594,453	50,399	452,745	2,109
2 ($\tau_1 - \tau_2$)	2.544,054	234,592	450,636	18,309
3 ($\tau_1 - \tau_3$)	2.309,462	173,755	432,327	27,862
4 ($\tau_1 - \tau_4$)	2.135,707	17,651	404,465	21,627
5 ($\tau_1 - \tau_5$)	2.118,056	23,103	382,838	12,169
6 ($\tau_1 - \tau_6$)	2.094,953	0,765#	370,669	0,073#
7 ($\tau_1 - \tau_7$)	2.094,188	7,003	370,596	22,193
8 ($\tau_1 - \tau_8$)	2.087,185	19,699	348,403	3,525
9 ($\tau_1 - \tau_9$)	2.067,486	1,049#	344,878	0,001#
10 ($\tau_1 - \tau_{10}$)	2.066,437	0,196#	344,877	12,000
11 ($\tau_1 - \tau_{11}$)	2.066,241	1,030#	332,877	0,000#
12 ($\tau_1 - \tau_{12}$)	2.065,211	1,103#	332,877	0,000#
13 ($\tau_1 - \tau_{13}$)	2.064,108	3,823	332,877	0,000#
14 ($\tau_1 - \tau_{14}$)	2.060,285	2,179#	332,877	0,000#
15 ($\tau_1 - \tau_{15}$)	2.058,106	-	332,877	-

Table 3: Fit Statistics for p* Model (G).
Note: The first parameter in each model is the intercept term. A stringent of $\lambda_P = 0{,}0001$ and $\lambda_C = 0{,}001$ is used, respectively. '#' indicates parameters whose absence does not change the pseudo-likelihood deviance substantially.
Source: Own calculations based on network data.

Model 1 is a baseline model and reflects the null hypothesis that the probabilities of graph realizations are uniform.[375] The baseline badness-of-fit of 2.594,453 and 452,745, respectively is quite large, relative to the size of the network, indicating that some unique structural tendencies exist here. Models 2 through 15 add, one at a time, various additional parameters. As successive models fit better, the -2 log likelihood, a fitness value that indicates "badness of fit," decreases. As outlined in Chapter 3 we regard certain structural components to contribute substantially to the predictive capacity of the

[375] The equivalent of an intercept term in regression analysis (see Chapter 3.2).

p* model, others not.[376] The latter parameters are indicated by '#', i.e. these parameters that are not important to a model's predictive capacity. For example, in case of the directorship network, adding a reciprocity parameter to model 1 leads to a relatively large improvement in fit. Model 6 adds a transitivity parameter to model 5, subsequently model 7 adds the cyclic parameter. The addition of cyclic parameters leads to a modest improvement in fit while the transitivity parameter leads to no appreciable increase in fit.

From Table 3 it becomes obvious that with regard to the directorship network parameters beyond τ_9 do not contribute substantially to the predictive capacity of the p* model, respectively for the ownership network structural components added from model 11 and higher. The fitted Markov random graph model for the Prime All Share network of interlocking directorates therefore comprising all parameters of model 8 excluding τ_6; the parameter estimates for the best-fit model[377] are listed in **Table 4**. Again, if there is a positive value for the Pseudo-likelihood estimation we follow that the conditional probability that the particular configuration is existent in the network is higher than the conditional probability that it is not existent (ceteris paribus); vice versa for a negative value.[378]

The best-fitting model[379] with regard to the ownership network comprising all parameters of model 10 excluding τ_6 and τ_9; a discussion of the results follows.

[376] With regard to the best-fit model a parameter is removed if the resulting change of deviance $|LR_{PL}|$ is less than 2.266 in case of the directorship network, and 2.677 respectively for the ownership network. λ has been defined individually for each partial network (for more see Chapter 3.3).
[377] The model is the best fitting, i.e. has the lowest "badness of fit".
[378] See Chapter 3.3.
[379] Fitting a model to data means finding the best (maximum likelihood) estimates of all parameters in the model (see Chapter 3).

	p* Model for the Directorship Network		
Network Parameter	β	*Wald – Statistic*	$\exp(\beta)$
τ_{1_P}	-5,9729	2.521,1832	0,0025
τ_{2_P}	3,2233	20,8815	25,1099
τ_{3_P}	0,0896	35,6005	1,0937
τ_{4_P}	0,1147	20,4115	1,1215
τ_{5_P}	0,0815	23,2354	1,0849
τ_{7_P}	0,0963	1,7565	1,1011
τ_{8_P}	0,9710	3,3797	1,1020
τ_{13_P}	0,0960	0,6760	1,1007

Table 4: p* Model for the Directorship Network (G).
Note: Parameters for the best-fitting (has the lowest "badness-of-fit") excluding parameters appointed to be "unimportant".
Source: Own calculations based on network data.

First, the table reveals evidence for interdependencies and reciprocal effects could be found that go beyond the dyadic level. Moreover, from the table it becomes obvious, that at the dyadic level a highly negative τ_{1_P} suggests no such tendency for a company to send a manager to another firm's supervisory board only, i.e. a single pair of actors to get tied only by a dyad. We therefore suggest Prime-All-Share members have a tendency to be embedded in the governance network by multiple directorships.

In a dyadic model a positive reciprocity parameter τ_{2_P} in the presence of a negative density, τ_{1_P}, indicates that there are more reciprocated ties than would be expected by chance, given the number of single dyads observed in the graph. The parameter estimate for τ_{2_P} is 3,2233, suggesting a very strong overall tendency for relational ties to be reciprocated. A glance at the directed graph presented earlier confirms this trend as there are clearly a large number of mutual ties as compared to non-mutual ties. Inspection of $-2L_{PL}$ for model 1 versus model 2 with regard to the directorship network in Table 4 reveals a large difference in fit. Thus, together with a large parameter estimate from Table 5 this is lending evidence to the importance of reciprocity. This is in contradiction to the suggestions made by *Beyer (1996)* who suggested the structural component reciprocity to be an exception. In his examination

comprising a sample 616 large German companies only 8.2% of the firms were tied reciprocally.[380]

A relatively high pseudo-likelihood ratio from model 2 to model 3 from Table 3 suggests high tendency for actors to have multiple network partners. The positive 2-out-star-parameter τ_{3_P} suggests that there are firms that send executives onto the supervisory boards of other firms to a great extent. However, the degree of reciprocity in the governance network does matter in this context: a number of firms do accept foreign mandates of these dominant actors onto their supervisory organ only if they are themselves hold mandates onto the respective panel of the same. This argument is underpinned by the positive estimation coefficient for τ_{8_P} .

The argument of an unequal distribution of control is supported by a positive beta estimation with respect to the 2-in-star-parameter τ_{4_P}. We therefore suggest that enterprises do exist within the network, whose supervisory boards comprising a high number of managers sent from other enterprises, and at the same time this respective enterprise does not sent any managers to the control body of the respective others. Similar to τ_{8_P}, parameter τ_{9_P} is not contained in the best-fitting model. We therefore suggest on a somewhat stronger concentration of exertion of control rather than imposition.

With regard to transitive actors' configurations indirect control is rather low within the network. However, the relevant parameter estimate τ_{5_P} is positive, thus we suggest for the Prime-All-Share network some kind of 2-mixed-stars. But, we tend to argue on no evidence for paths within the graph that go beyond two actors, i.e. a rather weak or no control from the first actor over the third given more than one other party in between.

From the results for intransitive configurations we may reject hypothesis 2: on the level of groups of participants the interdependence structures in the personal relations no evidence is found to exhibit any hierarchical character. The respective parameter τ_{7_P} amounts positive which can be interpreted that cyclic structural patterns are more

[380] See Beyer, J. (1996), pp. 90-91.

likely to occur. This is in contradiction to the empirical results of *Rank (2003)* who examined the small group DAX-30 members for 2002. The relevant transitivity parameter τ_{6_P}, is not contained in the model, thus the argument above is underpinned. Our empirical results with regard to intransitive (triadic) network configurations are in contradiction with the findings of *Beyer (1996)*. He argued the relevant configuration we termed τ_{7_P} the most unlikely to occur among all other configurations. Instead he argued on a high significance of a hierarchical element within the corporate relationships of control. In his study, he suggested pyramids to be highly relevant for his network.[381]

The coefficients for the parameter estimate for the contained p* model pertaining to the Prime-All-Share network of ownership ties are demonstrated in **Table 5**.

	p* Model for the Ownership Network		
Network Parameter	β	*Wald – Statistic*	$\exp(\beta)$
τ_{1_C}	-1,2602	9,0263	0,2836
τ_{2_C}	-4,8845	2,6533	0,0076
τ_{3_C}	0,0640	0,1521	1,0661
τ_{4_C}	-3,4034	53,1632	0,0333
τ_{5_C}	-1,6600	33,8827	0,1901
τ_{7_C}	-6,8369	0,0009	0,0011
τ_{8_C}	2,0243	11,8126	7,5711
τ_{10_C}	4,4837	0,0003	88,5660

Table 5: p* Model for the Ownership Network (G).
Note: Parameters for the best-fitting (has the lowest "badness-of-fit") excluding parameters appointed to be "unimportant".
Source: Own calculations based on the network data.

[381] See Beyer (1996), pp. 90-91.

On the dyadic level it becomes obvious, that French enterprises rarely tend to the structural patterns of isolated, single-directed ownership. The relevant parameter τ_{1_C} amounts negative. Given Figure 3 (sociograph) for visualisation the evaluation of this parameter becomes evident. However, in the present network a large number of cases can be identified where actors are tied as an isolated pair compared to the previously discussed directorship network. No such tendency of French enterprises can be seen for reciprocity. The respective parameter estimate τ_{2_C} amounts strongly negative. But, parameter τ_{8_C} , containing the reciprocity parameter, is positive. This leads to the conclusion of a stronger execution of control rather than actors' maintenance of control within the ownership network. A large parameter estimate for τ_{10_C} by contrast leads to the assumption that reciprocal control by cross-shareholdings is very likely to occur.

The intransitive 2-out-star parameter τ_{3_C} is positive, thus we suggest enterprises do exist that own financial participation on others to a high degree. A negative τ_{5_C} may lead to the suggestion that firms are rather not tend to go for 2-mixed-stars, whereby a strongly negative 2-in-star parameter τ_{4_C} shows that actors do exist that are largely owned by other members that can be assigned to the network sample but at the same time do not have cross-ownership with the respective counterparty.

Results for transitive network configurations can be interpreted the following: a large negative beta for the cyclic triads parameter τ_{7_C} means that cyclic patterns are less likely to occur; i.e. there is no scenario where a firm holds share of himself in the end. *Adams (1994)* found evidence for circular financial participation between central actors in the German ownership network.[382] With respect to the network core in our sample, no evidence is found. No statement can be made with respect to transitivity in the Prime-All-Share ownership network systematic; parameter τ_{6_C} has been abandoned from the best-fit model. From this, we conclude that no such hierarchical structure is likely to be existent for the ownership network.

[382] See Adams, M. (1994), p. 150.

4.2.4 Summary

This country study focuses on the analysis of the German corporate network, for the purpose of this study established by interlocking directorates and capital linkages between large German corporations.

Based on the descriptive measures assigned to the social network analysis on the surveyed network data, a number of statements can be drawn:

Evidence could be found that there is a persistent demand of information and control of firms over others. The total network is characterised by an extensive and dense network of corporate relations with a large number of German corporations integrated. Thus, a complex of interweaving corporate interlocks between a set of firms within the Prime All Share Index is observed. The German corporate network is primarily determined by the pattern of its interlocking directorships, i.e. corporate control in Germany is more instrumentalized by interlocking directorships. The structural analysis of the partial networks leads to the conclusion that the capital network is characterised by a lower density and a lower degree of centralisation in comparison to the personal network. The capital network among firms in its current state can be described as relatively simple and as less dense which makes it relatively transparent.

Examining the underlying systematic logic of the governance structure in the network[383] with a particular focus on the triadic microstructure the following findings can be summarised:

Evidence for local regularities in the interlock between enterprises has been found for networks, directorship and ownership. We suggest triadic structural components to play an important role for large German enterprises. The general hypothesis that interdependencies between shareholdings and the exertion of personal control does exist, therefore, can be confirmed. Thus, individual IORs within the German governance system are not independent from each other. The decision whether a company enters into a power relation with another company by the delegation of a manager depends substantially on existent further relations of the same type between

[383] For the purpose of this study, the governance network can be understood as the aggregation of the two partial networks, directorship and ownership.

both enterprises. As expected, since network governance needs to be achieved across the entire network, directorship and ownership ties show both dyadic and extra-dyadic patterns of interdependence (hypothesis 1 confirmed).

With regard to directorship mandates a strong tendency for reciprocity can be assigned to the large German enterprises. Moreover, no evidence for the interdependence structure in the personal relations to exhibit a hierarchical character is found. Thus, hypothesis 2 is rejected. For the ownership network our exploratory analysis of triad structure reveals a structural tendency towards intransitive 2-out-star triadic patterns and intransitive mutual triads. Thus, we suggest a strong mutual entwinement with preferred mutual control through cross-shareholdings within the Prime-All-Share network. The tendency for this particular structural pattern between firms may suggest a corporate strategy of "mutual hostages" *(Williamson, 1985).*[384] In other words, firms tend to aim for balances of power within the network by the means of cross-shareholdings. However, no clear tendency can be suggested with regard to transitivity within the cross-ownership structure, thus no clear statement can be made regarding any hierarchy in this partial network.

[384] See Williamson, O. E. (1985).

4.3 Country Study: United Kingdom

The British Corporate Governance system is well known as a market-based and shareholder value-oriented system. In such systems the objectives and intervention rights of financial claimants differ substantially from those in relational-insider countries. This argument is supported by two major features of the British system: it has large and active equity markets, big firms are publicly listed, and, if necessary, firms can raise significant amounts of external capital from equity and debt markets; secondly, equity holdings are relatively dispersed, but financial institutions, other than banks, collectively hold a sizeable proportion of total equity.[385] Moreover, the UK is characteristic for an outsider-control system. The governance system is essentially indirect and is exerted to a considerable degree through divestments and the market for corporate control.[386]

The British corporate governance structure is characterised by a great number of cross-involvements at the level of the board of directors, i.e. intense corporate board-to-board relationships. Characteristic for the ownership structure of British enterprises is that a high portion of the large enterprises is not held by families or private persons but rather held by other enterprises.[387] Equity holdings are relatively dispersed, but financial institutions, other than banks, collectively hold a sizeable proportion of total equity.[388] We therefore expect a large web of inter-firm cross-shareholdings within the British governance system. But, as public equity markets are large and ownership is much dispersed the majority of equity is hold by investors who are not closely involved with the firm;[389] i.e., a large majority of the listed companies in Britain have a dominant outsider shareholder or investment group, but, although their accumulated share stakes are significant, shareholdings in individual companies are small.[390] The very large and

[385] See Shleifer, A. / Vishny, R. W. (1996), p. 49 ff.
[386] See Gospel, H. / Pendleton, A. (2003), p. 563.
[387] See Windolf (1994), p. 86.
[388] See Shleifer, A. / Vishny, R. W. (1996), p. 49 ff.
[389] See Shleifer, A. / Vishny, R. W. (1998), p. 23.
[390] See Goergen, M. / Renneboog, L. (2001), p. 260.

liquid capital market plays its role as an independent evaluation institution, a market of takeovers and as a very active market for corporate control.[391]

In comparison, UK is the only country of the three nations considered in this study with an active hostile market for corporate control. Furthermore, the UK differs from other European countries not only in her higher proportion of listed firms, but also in ownership concentration and the main shareholder class.[392] A large majority of the listed companies in Continental Europe have a dominant outsider shareholder or investment group; most UK firms are controlled by insider shareholders[393],[394] whereas in France and Germany large shareholder stakes are held by outsiders. However, an increasing and very significant number of firms are owned wholly or partly by foreign investors.[395] The UK also differs sharply from Continental Europe in the much more important presence of institutional investors holding a very high percentage of the total UK market capitalization. Pension funds, mutual funds and investment funds, in particular, play a major role within the well-organised British capital market.[396] But, although their accumulated share stakes are significant, shareholdings in individual companies are small.[397] While there is a relatively high degree of ownership concentration prevalent in Germany, British ownership structure is highly fragmented.[398] Most UK firms are controlled by insider shareholders (the management and members of the board of directors), whereas in France and Germany large shareholder stakes are held by outsiders. Whereas in the UK family ownership is not common among large enterprises in Germany a lot of equity is financed non-publicly by families who have some degree of long-term commitment to the firm.[399] The UK also differs sharply from the other two nations in the much more important presence of institutional investors. However, institutional involvement in the UK is low; although the accumulated share stakes of institutional investors are significant, shareholdings in

[391] See Lambach, D. / Maess, E. (2002), p. 35.
[392] See Franks, J. / Mayer, C. (1995), pp. 1 ff.
[393] The management and members of the board of directors.
[394] See Goergen, M. / Renneboog, L. (2001), p. 259.
[395] See Shleifer, A. / Vishny, R. W. (1996), p. 49 ff.
[396] See Witt, P. (2003), p. 93.
[397] See Goergen, M. / Renneboog, L. (2001), p. 260.
[398] See Windolf, P. / Beyer, J. (1995), p. 1 ff.
[399] See Shleifer, A. / Vishny, R. W. (1996), p. 49 ff.

individual companies are small.[400] Although the British CG system is a more capital-market oriented system rather than a bank-dominated system like the Germany one,[401] the lending market though plays a major role of control, especially for medium and small-sized enterprises.[402] Furthermore, the British and German Corporate Governance systems can be compared and contrasted by dichotomies such as insider versus outsider control, bank and company based versus capital market based, consensus versus conflict as well as stability versus flexibility in business connections.[403]

Throughout the study we refer to existent empirical results of network-analytic investigations of the British governance network found in literature, among others, for example, *Windolf / Beyer (1995)*, *Franks / Mayer (1997)*, and *Goergen / Renneboog (2001)*.

4.3.1 Sample and Data

The dataset captures the largest public stock corporations (=N^{UK}) listed in the FTSE-350 Supersector Indice in the composition as of end of year 2004 (reporting date January 1, 2005).[404] FTSE-350 is the aggregation of the FTSE-100 which represents the 100 most highly capitalised blue chip companies and the FTSE-250 comprised of mid-capitalised companies, together representing approximately 95% of the UK market capitalisation. The 2004 sampling frame included 350 corporations listed at the London Stock Exchange (LSE).[405]

A descriptive analysis of the British corporate network structure is carried out using tools und methods that could be assigned to social network analysis. Subject of analysis are interlocks between firms that form part of the sample (particularly the interlocking directorates and shareholder-crossings). Coefficients were computed for the total sample of 350 firms; we explored our hypothesis using data on networks consisting of

[400] See Goergen, M. / Renneboog, L. (2001), pp. 259-260.
[401] CG systems usually depend on the particular financial systems. These can be classified roughly as bank or capital market-oriented. The British model shows all characteristics of a truly capital market orientation. For more see Lambach, D. / Maess, E. (2002), p. 35.
[402] See Witt, P. (2003), p. 94.
[403] See Matthes, J. (2000), p. 21; see Albers, M. (2002), p. 28; see Leyens, P. C. (2003), p. 63; see Banks, E. (2004), pp. 54-82.
[404] Throughout the study, the term ‘company’ or ‘firm’ is employed, always referring to a member of the FTSE-350.
[405] An alphabetic listing of all the companies can be found in the Appendix.

263 firms that had entered into the directorship network, and 307 firms with regard to the ownership network.

Managers can be a member of the board of one firm and, at the same time, hold a mandate in the governance body of another firm,[406] thereby creating a network of directorates.[407] For the purpose of this study, an interlocking directorship is established by a director being the Chairman (in both positions, non-executive and executive)[408], the Chief executive or an ordinary executive member of the board of one firm and, at the same time, holding a non-executive seat on the board of one or more firms that could be assigned to the sample other than the respective one. To give an example, Tony Hayward is an executive director of BP Plc and a non-executive director of the Corus Group Plc; Sir John Bond holds the Chairman position of the board of HSBC Holding Plc and, at the same time holds a non-executive directorship at the Vodafone Group Plc. Subject to certain conditions, and unless otherwise determined by the Board of the respective company, each Executive Director is permitted to accept only one appointment as a non-executive director of another company. In fact, the total number of interlocks is exceedingly higher when collecting non-executive directorships held by non-executive directors.[409, 410] Data on board directorships was collected from the Annual Reports of the sampled firms for the year 2004 (as of 31.12.) restricted to directive directorships, as no reliable public database covering directorships could be found.[411]

[406] The UK board system is a monistic approach of a corporate legal structure, also referred to as one-tier system. The single-board system of administration combines supervisory and executive function within one organ, the "Board of Directors" (see Ezzamel, M. / Watson, R. (1997), p. 54).

[407] See Windolf, P. (1994), p. 82.

[408] There is an important distinction between non-executive board members and independent board members. All independent directors are non-executive, but not all non-executives are independent (see Merson, R. (2003), p. 13); for example, important shareholders can be non-executives, but no independent board members (see Carter, D. B. / Lorsch, J. W. (2004), p. 97). Ideally all members of the board (excluding the CEO and possibly one other member of top management) should be independent, in order to properly fulfil their functions (see Hilb, M. (2005), p. 54). Recommended criteria for independent board members are set out, among others, in the Cadbury Report (see Cadbury, A. (2002) p. 21).

[409] For example: Kathleen (Kate) Nealon was appointed a non-executive director of HBOS PLC in January 2005. She is also a non-executive director of Cable & Wireless PLC.

[410] In the sense of a governance perspective, for the purpose of this study, these external mandates are not surveyed

[411] In some cases we collected the information from the annual report of the respective group company; in some cases we contacted the IR responsibilities of the respective company.

Data on ownership ties was collected from the Annual Reports 2004 as no reliable public databases covering shareholdings could be found and is restricted to direct and indirect ownerships. The relevant share capital is defined as the voting capital, i.e. the regulations only refer to interests in shares that carry rights to vote in al circumstances at general meetings of the company.[412]

In some cases we contacted the investor relations departments of the respective enterprise. Public business corporations need to declare holdings above the threshold of three percent.[413] Shareholders who own shares indirectly through subsidiaries are required to disclose their combined direct and indirect holdings. We consider such stakes as an ultimate share stake. Indirect ownerships[414] of firms are only considered if held through wholly owned subsidiaries[415].

To give an example: Legal & General Investment Management Ltd holds 4.03% of Carnival Plc. At the same time Legal & General Group Plc holds 3.52% of Carnival Plc. Legal & General Investment Management Limited is a wholly owned subsidiary of Legal & General Group Plc. Thus, Legal & General Group Plc holds direct and indirect investments on Carnival Plc, the ultimate share stake amounts 7.55%. In contrast: major shareholder of Fidelity European Values Plc, a listed company of FTSE-350, with 27% share stake is Fidelity Investment Management Ltd. Fidelity Investment Ltd owns shareholdings of 7.31% of McAlpine (Alfred) Plc, which is also listed in the FTSE-350. Thus, an indirect investment could be identified for Fidelity European Values Plc on McAlpine (Alfred) Plc. This type of indirect ownership is neglected in this study; however it could be assumed that no major bias may result from these constraints.

However, it should be noted that the full extent of cross-holdings in UK is not publicly known, as cross-holdings are frequently subdivided so that they remain below

[412] See Goergen, M. / Renneboog, L. (2001), p. 263.

[413] Listed companies must inform the Company Announcements Office (CAO) at the London Stock Exchange (LSE) immediately of any notifications of major interests received under Sections 198-208 of Companies Act 1985. See Sections 198-200 Companies Act of 1989 (hereafter CA 1989).

[414] For the purposes of this study, an indirect investment is an equity investment of one firm held through another party.

[415] A wholly-owned subsidiary is a company that does not have any members apart from the parent company, the parent company's wholly owned subsidiary(ies) acting on behalf of the parents company. The Companies Act of 1989 defines parent company and wholly-owned subsidiary.

the threshold levels that would imply mandatory publication.[416] Moreover, the register of shareholders may not necessarily reveal the true beneficial holdings[417] as 'nominee' companies may register shares on behalf of a third party.

A detailed overview of the interlocking ties between the members of the sample defined in accordance with the definitions set out here is shown in the Appendix.

4.3.2 Descriptive Statistics

For the target year 2004 the total number of directive interlocking directorships between members listed in either the FTSE-100 or FTSE-250 amounts 854; the number of multiple interlocks (multiple directorships) in total amounts five, whereby four cases could be identified where two actors are linked by two directorships,[418] one pair of actors is linked by four directors.

The maximum number of possible relations between actors within the defined network[419] comprising of 350 actors is 122.150 ($=M^{UK,\#}$). Thus, a network density of $\Delta p = 0.699\%$ is computed,[420] the network density without considering the isolated firms assigned to the FTSE-350 amounts $\Delta p^{l} = 1.239\%$.[421] Taking multiple directorships into calculation,[422] a density of $\Delta p^{d} = 0.688\%$ is computed.

With regard to the structure of interlocks on the individual actor level we found a maximum outdegree of 8, the median degree amounts 1.220.[423] Thus, here from we can suggest a broad integration of firms into the directorship network; power is rather less concentrated with respect to the sender companies. This is underpinned by a relatively high number of intermediaries; a relatively low degree of network centralisation also gives support to our argument.

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[416] UK Company Law imposes a threshold of 3% for stakes (see Section 198-208 of CA 1989).
[417] Beneficial refers to the fact that the person enjoys all the proprietary rights. Non-beneficial shares are held by a trustee, usually for a family, charity or corporation that will receive dividends.
[418] To give an example: Sir Julian Horn-Smith is an executive director (Deputy Chief Executive) of Vodafone plc is also a non-executive director of Lloyds TSB Group plc and Smiths Group plc.
[419] True for both personal and capital network. One firm could hold share capital of itself; however, this is not studied in this paper.
[420] See Table 6: Row 8.
[421] See Table 6: Row 9.
[422] Sociometric data dichotomised.
[423] See Table 6: Row 7.

In contrast to the directorship network, descriptive figures for the ownership network suggest the following: the network is highly interlocked, the number of cross-shareholdings between the 350 members of the FTSE-350 amounts 1.228;[424] to put it another way, 87.71 percent of the firms assigned to our sample are connected somehow to the ownership network. Thus, a very high degree of embeddedness can be suggested. Given a network density of $\Delta p = 1.005\%$,[425] the network of cross-shareholdings is nearly twice as dense as the board-to-board network. However, the degree of network centralisation[426] and the actors' centrality degrees reveal the conclusion that the network is rather ego-centric with a small number of central actors.[427] This argument is underpinned looking at the structure of interlocks on the level of the individual actors, allowing us to draw conclusions on the degree of embeddedness into the network.[428]

The principal findings regarding the structural features on the personal network and capital network are summarized in **Table 6**.

[424] See Table 6: Row 2.
[425] See Table 6: Row 8.
[426] The general measure of centralization proposed by Freeman (1979) tries to capture the extent to which a network consisted of a highly central actor - or in this context, a small set of central actors - surrounded by peripheral actors.
[427] See Table 6: Row 6 and Row 7.
[428] Following the analysis of *Windolf / Beyer (1995)*, firms can be assigned to different roles such as sender, receiver, and intermediary and isolates. See Table 6: Row 5.

		United Kingdom					
		Directorship Network			Ownership Network		
1	Number of firms that form part of the sample (=N^{UK})	350					
2	Number of interlock ties ($M^{UK,P}$; $M^{UK,C}$)	854			1.228		
3	Number of multiple interlocks / direct corporate interlocks						
4	Number of Isolates / Linked firms (in % of N^{UK})	87 (24.86)	263 (75.14)		43 (12.29)	307 (87.71)	
5	Number of Sender / Receiver / Intermediaries	205	225	263	28	302	307
6	Degree-based network centralisation	0.000458			0.505542		
7	Centrality degree						
	- outdegree (Max. ($O^{UK,P*}$; $O^{UK,C*}$)/ Med. / StDev.)	8	1.220	1.406	249	1.754	15.250
	- indegree (Max. / Med. / StDev.)	6	1.220	1.232	6	1.754	1.149
8	Network density (overall) in %	0.699			1.005		
9	Network density (without unlinked firms) in %	1.239			1.307		

Table 6: Structural Features of the Partial Networks (UK).
Note: Relative numbers are in parentheses.
Source: Own calculations based on empirical data.

Looking at the structure of reciprocal cooptation no such centre can be identified explicitly. However, although there is no clear distance between highly embedded actors and the remainder a group of 38 entities is defined to govern the directorship network more that others, thus forming a kind of core.[429] Again, it should be noted, that there is no significant break in terms of the number directorships held per actors that allows a clear distinction between central actors and periphery. This argument is underpinned by the visualisation of the board-to-board network in Figure 7.

In contrast, analyzing the configuration of the ownership network adjoined to the core-periphery-model we conclude on a completely different mapping. A small number of central actors are identified holding nearly ninety percent of all ownership ties (outdegree). On the other hand, a large number of peripherical actors are identified; the majority is dependent to the network core. The peripherical actors themselves are less

[429] Corporations are defined as being a member of the network centre if either their indegree or outdegree amounts are higher than 5. The approach taken here does not follow the work of Borgatti / Everett (1999) in the case that we individually set the core members as a set of actors that are significantly higher embedded within the network.

tied to each other; isolated social circles are rather rare within the network of cross-shareholdings.

The network of directorships and the ownership network are illustrated by a sociograph in **Figure 7** and **Figure 8**. For the purpose of the visualisation of the large network comprising of 350 actors for the directorship network only the linked firms are considered in the figure; i.e. we dropped non-linked firms from the graphs. It becomes obvious, that the web of relationships becomes relatively complex depending on the number of actors and ties it contains. With respect to the ownership network - comprising nearly 90 percent of the FTSE-350 members – additionally to the constraint above those who are single-bounded to the network are expelled from the sociogram. However, an important structure-analytic realization can still be recognized from the figure: there are two stable groups of cross-shareholding, each constructed around a major bank and a holding company. The first has Barclays Plc at its core; the other Legal & General Group Plc.[430] Results are supported by the empirical examination of *Goergen / Renneboog (2001)*.[431] They found the five most frequently represented institutions can be assigned to insurance companies and investment funds. With respect to our sample, the core of the network comprising of seven members, all of them can be assigned to the industry group of financials.[432]

[430] Beyond, the core is established by the following actors (sum of indegree and indegree amounts higher than 20): HBOS Plc, Lloyds TSB Group Plc, Aviva Plc, Prudential Plc, Schroders Plc. All of these members have significantly higher degrees compared to the remainder.
[431] Goergen / Renneboog (2001) found the institutional investors with the greatest number of ultimate voting blocks in a sample of 250 companies in 1992.
[432] See industry group classification of FTSE (2005).

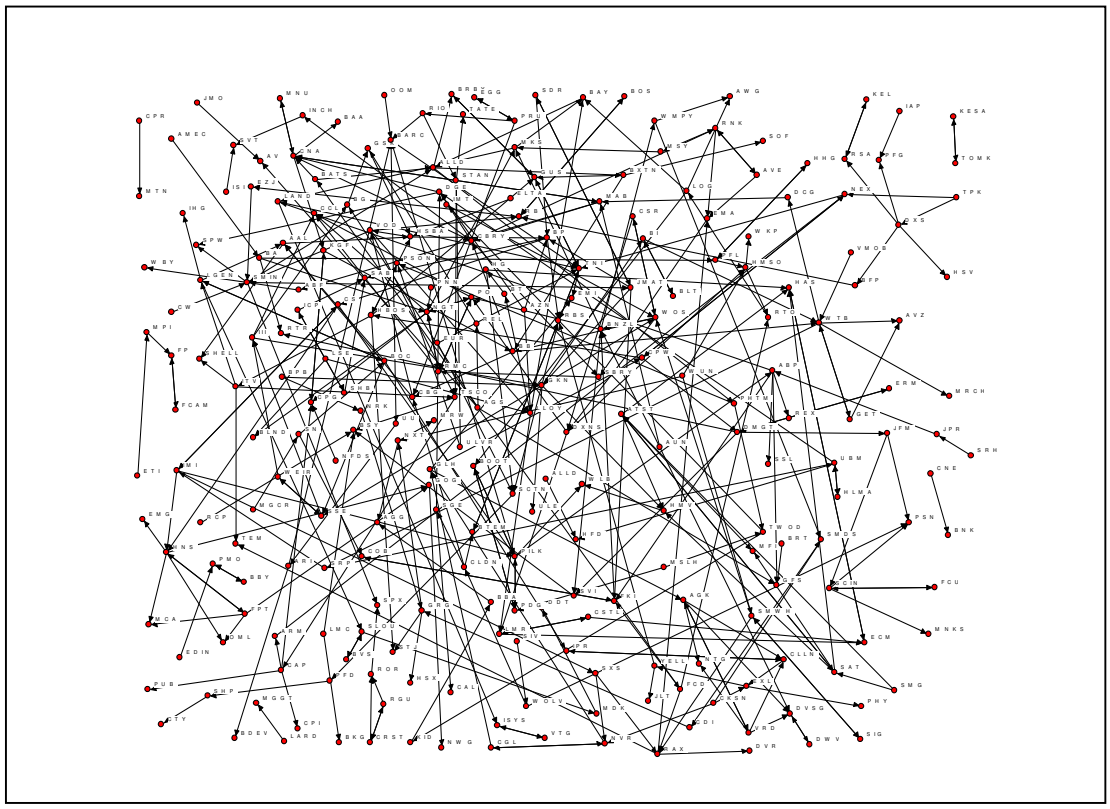

Figure 7: Sociograph for the Personal Network (UK).

Note: Illustration without isolated actors; firms labelled with their respective ticker symbol.

Source: Sociograph developed with NetDraw [433], Version 2.17, based on surveyed network data (dichotomized).

[433] NetDraw is a program for drawing social networks. NetDraw is free and may be freely distributed. For more information about the program, contact its author, Steve Borgatti, at steve@analytictech.com or +1 978 456 7372.

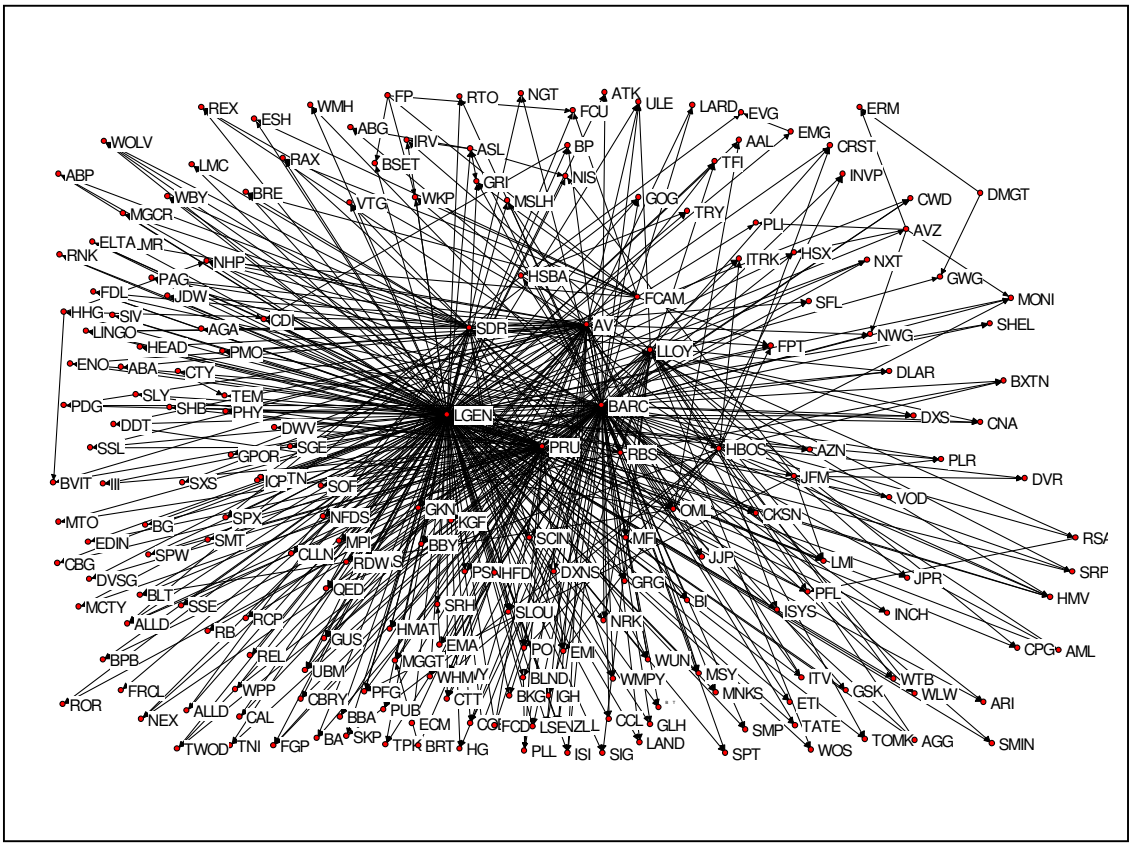

Figure 8: Sociograph for the Ownership Network (UK).
Note: Illustration without isolated actors and actors single-bounded to the network; firms labelled with their respective ticker symbol.
Source: Sociograph developed with NetDraw [434], Version 2.17, based on surveyed network data (dichotomized).

Figure 9 demonstrates the concentration of mandates held by firms that could be assigned to the British sample. From the figure it becomes evident, that the number of external directorships for Executive Directors per firms is distributed quite as one would expect. Two third of the firms have one or two Executive Directors sent onto the board of other firms.

[434] NetDraw is a program for drawing social networks. NetDraw is free and may be freely distributed. For more information about the program, contact its author, Steve Borgatti, at steve@analytictech.com or +1 978 456 7372.

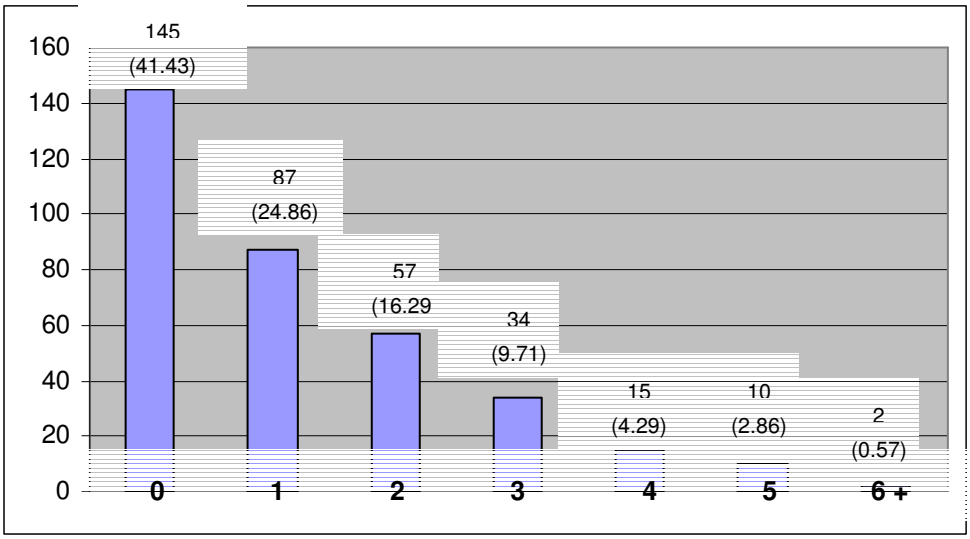

Figure 9: Distribution of Directorships per Actor (measure: outdegree) (UK).
Note: Relative numbers are in parentheses.
Source: Based on empirical network data.

The descriptive results from **Figure 10** generally confirm the tendency derived from the results of *Goergen / Renneboog (2001)*. Based on their empirical examination for a sample of 250 randomly selected companies they argued on a small portion of the companies with the largest voting block exceeding the veto threshold of 25 percent with regard to the concentration ratios.[435] But, in contrast to our descriptive results illustrated in Figure 10, they observed on a size distribution of the top shareholders the median largest block to be about 10 percent and for about two fifth of the companies the largest shareholder owning a stake of between 5 percent and 10 percent. For the FTSE-350 sample we found the majority holding stakes less than 25 percent, obviously intending on holding the largest equity stake possible without transgressing the 30 percent mandatory takeover threshold. Of 344 sample companies in 2004, ten financial participations held by corporate shareholders exceeding 24.9 percent. With regard to corporate shareholders we suggest the FTSE-350 members tend to have a dispersed ownership structure.

But, whereas the relatively low values suggest that the stakes are spread out over several corporate shareholders, network data reveals that there are only a few firms

[435] Figures with regard to all types of shareholders, not only corporate shareholders.

holding a high number of financial participations. Thus, a highly concentrated interlock network can be suggested. This becomes obvious in Figure 11.

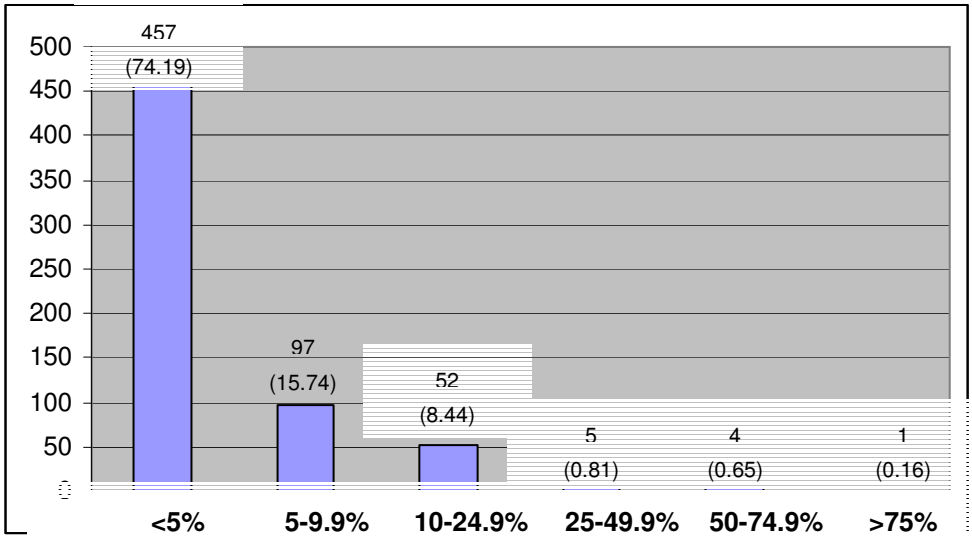

Figure 10: Degree of Ownership Concentration (Proportion of Stock Owned in %) (UK).
Note: Measure is the outdegree. Relative numbers are in parentheses.
Source: Based on empirical network data.

The results of a more comprehensive analysis of the structure of cross-shareholdings is demonstrated in **Figure 11**. The suggestions made above are underpinned: with respect to the ownership network we found a high concentration of power on a few actors; secondly, a broad integration can be observed. Interestingly, a high number of intermediaries are identified.

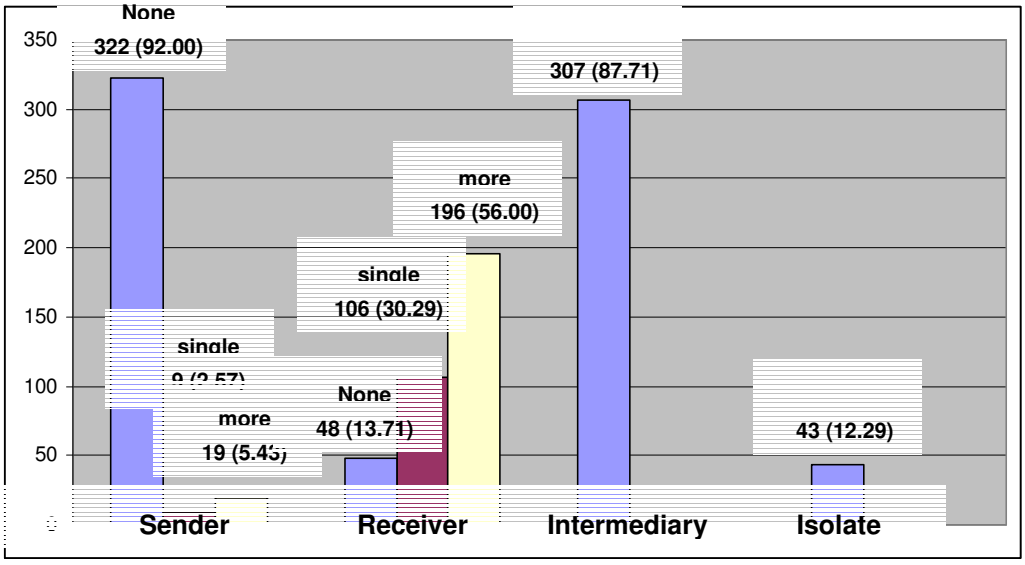

Figure 11: Structure of Cross-Shareholdings (UK).
Note: Measure is the outdegree. Relative numbers are in parentheses.
Sender: no participation (none), one participation (single), more than one participation (more);
Receiver: no owner (none), one owner (single), more than one owner (more).
Source: Own calculations based on network data.

From a total network perspective some degree of overlap between the two partial networks can be assumed. For the FTSE-350 network 15 cases of overlapping ties are identified.

However, statements from the descriptive analysis with regard to the governance network structure are limited in information. An additional examination of the underlying structural logic of the predefined networks focusing on dyadic and triadic relations between actors might reveal more useful findings. A discussion around the empirical results of a discrete, uni-variate analysis regarding the triadic microstructure in both partial networks described here will be presented next.

4.3.3 Empirical Results

The discussion of p* that follows center around the British directorship network of 263 linked firms and the British ownership network of 307 linked firms. Thus, $\binom{263}{3}$=2,997,411 and $\binom{307}{3}$=4,775,385 non-null triads are possible in the respective partial network: $\Im = \{T_{1,2,3}, T_{1,2,4}, \ldots, T_{261,262,263}\}$ and $\Im = \{T_{1,2,3}, T_{1,2,4} \ldots, T_{305,306,307}\}$, respectively. **Table 7** presents counts of the various relevant types of triads from the

triad census, thus the information from the sociomatrix X is reduced to sixteen summary statistics (τ_0 - τ_{15}).

		Triad Census	
No. of Arcs	**Network Configuration**	**Directorship Network**	**Ownership Network**
0	τ_0	2,640,335	2,634,994
1	τ_1	79.350	66,420
2	τ_2 ; τ_3 ; τ_4 ; τ_5	10,441 ; 151 ; 243 ; 434	32 ; 198 ; 29,059 ; 78
3	τ_6 ; τ_7 ; τ_8 ; τ_9	1 ; 3 ; 52 ; 95	133 ; 0 ; 189 ; 1
4	τ_{10} ; τ_{11} ; τ_{12} ; τ_{13}	4 ; 23 ; 1 ; 0	0 ; 31 ; 0 ; 0
5	τ_{14}	0	0
6	τ_{15}	2	0

Table 7: Triad Census (G).
Note: The sixteen types of triples are presented in the no. of arcs present.
Source: Pajek[436]-report reading network data.

From the figures we can suggest some triadic behaviour for the FTSE-350 members with respect to both forms of institutional linkages. This assumption is apparently supported by the sociograms in Figure 7 and Figure 8 and the descriptive measures from Chapter 4.1.2.

The p* results for the uni-modal triadic analysis are presented next. At first the goodness-of-fit statistics for the p* model is shown, respectively for the directorship and ownership network, in **Table 8**.

[436] A program developed by Vladimir Batagelj (Department of Mathematics, FMF, University of Ljubljana, Slovenia) and Andrej Mrvar (Faculty of Social Sciences, University of Ljubljana, Slovenia) for (non-statistical) analysis and visualization of large networks. The latest version of Pajek is freely available, for non-commercial use, at its homepage: http://vlado.fmf.uni-lj.si/pub/networks/pajek.

	Goodness-of-Fit for p* Model			
	Directorship Network		Ownership Network	
Level (=No. of model parameters)	$-2L_{PL}$	$-LR_{PL}$	$-2L_{PL}$	$-LR_{PL}$
1 (τ_1)	4,025.177	114.763	3,999.074	1.112#
2 ($\tau_1 - \tau_2$)	3,910.414	485.067	3,997.962	1,220.742
3 ($\tau_1 - \tau_3$)	3,425.347	433.792	2,777.220	158.604
4 ($\tau_1 - \tau_4$)	2,991.555	26.601	2,618.616	0.339#
5 ($\tau_1 - \tau_5$)	2,964.954	22.062	2,618.277	22.795
6 ($\tau_1 - \tau_6$)	2,942.892	3.634	2,595.482	0.865#
7 ($\tau_1 - \tau_7$)	2,939.258	20.279	2,594.617	-
8 ($\tau_1 - \tau_8$)	2,918.979	2.679	-	-
9 ($\tau_1 - \tau_9$)	2,916.300	5.200	-	-
10 ($\tau_1 - \tau_{10}$)	2,911.100	0.000#	-	-
11 ($\tau_1 - \tau_{11}$)	2,911.100	3.462	-	-
12 ($\tau_1 - \tau_{12}$)	2,907.638	5.611	-	-
13 ($\tau_1 - \tau_{13}$)	2,902.027	0.998#	-	-
14 ($\tau_1 - \tau_{14}$)	2,901.029	3.084	-	-
15 ($\tau_1 - \tau_{15}$)	2,897.945	-	-	-

Table 8: Fit Statistics for p* Model (UK).

Note: The first parameter in each model is the intercept term. A stringent of $\lambda_P = 0{,}0001$ and $\lambda_C = 0{,}0001$ is used, respectively. '#' indicates parameters whose absence does not change the pseudo-likelihood deviance substantially.

Source: Own calculations based on empirical data.

The baseline badness-of-fit with respect to both partial networks is quite large, indicating that some unique structural tendencies respectively might exist.

From Table 8 it becomes obvious that with regard to the directorship network all parameters excluding τ_{10} and τ_{13} do contribute substantially to the predictive capacity of the p* model. The parameter estimates for the explanatory variables listed in the first column with respect to the best-fitting model, i.e. the model with the lowest "badness of fit" from Table 8, are presented in **Table 9**. In terms of the log linear form of p*, a large positive value of a parameter suggests the presence of the associated network structural

component (such as, for example, reciprocity), while a large negative value suggests its absence. Since the explanatory variables are measured on different scales, the notion of a "large" or "small" value is not especially well-defined. Thus, in order to determine a single parameter's contribution to the overall likelihood, one can fit a smaller model without the parameter and inspect the increase in -2L, as previously discussed. Dually, one can interpret the parameters in terms of logit p*. An example is given below.

With respect to the ownership network only three parameters are rather appropriate to include into the fitted Markov random graph model. Thus, only limited information can be extracted from the surveyed network data due to restrictive constraints for modelling reasons. However, a discussion of the figures might still be useful; the parameter estimates for the remaining configurations are demonstrated in **Table 9**.

	p* Model for the Directorship Network		
Network Parameter	β	$Wald - Statistic$	$\exp(\beta)$
τ_{1_P}	-6.9010	3,176.9521	0.0010
τ_{2_P}	3.7267	35.9987	41.5398
τ_{3_P}	0.1710	246.1496	1.1864
τ_{4_P}	0.1712	143.5345	1.1868
τ_{5_P}	0.0591	29.7605	1.0609
τ_{6_P}	0.1073	17.1035	1.1133
τ_{7_P}	0.0117	0.0180	1.0118
τ_{8_P}	-0.1321	13.2245	0.8763
τ_{9_P}	-0.1174	6.8952	0.8892
τ_{11_P}	0.0735	0.5358	1.0763
τ_{12_P}	0.1721	2.2995	1.1878
τ_{14_P}	-0.0187	0.0084	0.9815
τ_{15_P}	1.6517	2.4652	5.2157

Table 9: p* Model for the Directorship Network (UK).
Note: Parameters for the best-fitting (has the lowest "badness-of-fit") excluding parameters appointed to be "unimportant".
Source: Own calculations based on empirical data.

On first sight, figures from Table 9 reveal interlocking directorships between British enterprises are likely to show both dyadic and extra-dyadic structural patterns of interdependence. Large beta estimation for the reciprocity parameter τ_{2_P} indicates a strong tendency for relational ties to be reciprocated. A large decrease in the -2 log likelihood from model 1 to model 2, same for the subsequent step to model 3, suggests high tendency for actors to have multiple network partners. This argument is supported by positive beta estimation for the majority of the parameters included in the best-fitting model. The positive 2-out-star-parameter τ_{3_P} and the positive beta estimation for parameter τ_{4_P} (2-in-star) also provides evidence for a highly interconnected, multiple directorship network. A rather weak value for τ_{5_P} leads to the conclusion that actor' paths with more than one intermediary in between is not likely to occur. The transitivity parameter τ_{6_P} which might give support to any hierarchical characteristic to the directorship network, here, is positive whereas τ_{7_P} is positive but rather low. Thus, we follow on the structural tendency towards a hierarchical order within the network rather than homogeneity.

Negative parameter estimation for τ_{8_P} and τ_{9_P} leads to the conclusion that structural components in network architecture with the characteristic of unequal distribution of power are not preferred by the FTSE-350 actors. A negative beta estimation for τ_{14_P} , whereas the coefficient for τ_{15_P} is positive suggests an equivalent position of actors in terms of power dependence and a high degree of embeddedness within the network. Again structural tendency for reciprocity within the network is underpinned.

	p* model for the ownership network		
Network Parameter	β	$Wald - Statistic$	$\exp(\beta)$
τ_{2_C}	-8.2306	0.0147	0.0003
τ_{3_C}	0.0280	1,734.0256	1.0284
τ_{5_C}	-0.0155	1.0679	0.9847

Table 10: p* Model for the Ownership Network (UK).
Note: Parameters for the best-fitting (has the lowest "badness-of-fit") excluding parameters appointed to be "unimportant".
Source: Own calculations based on empirical data.

Apparently from Table 10 only limited information can be taken given the possible 15 network configurations described in Chapter 2.4. Less importance may be given to reciprocal cross-shareholdings: the respective parameter τ_{2_C} is highly negative which might give support to our suggestion the British ownership network is highly and unidirectional power-distributed, a major characteristic of an ego-centric network. This is also supported by a positive 2-out-stars estimate τ_{3_C}. With respect to the reciprocity parameter the following example will demonstrate the respective coefficients figures in a different way: as the number of reciprocal dyads involving the tie from actor i to actor j increases by one, and the other explanatory variables remain constant, the odds that i sends a tie to j increase by a factor of $\exp(\beta) = 0.0003$, thus remains nearly constant.

A negative value for 2-mixed-stars parameter estimation τ_{5_C} may confirm our assumption of an ego-centric from of the British corporate ownership network, i.e. no such structural tendency for triad microstructure behavior in favor of 2-mixed-stars can be suggested.

4.3.4 Summary

This country study focuses on the analysis of the British corporate network, for the purpose of this study established by interlocking directorates and capital linkages between large British enterprises. Based on the descriptive measures assigned to the

social network analysis on the surveyed network data, a number of statements can be drawn:

Evidence has been found for the British governance system to be described by intense board-to-board relationships as well as a great number of interlocking ownership between corporate actors. Thus, an extremely complex web of relations is established for the total network, respective evidence to the partial networks can be easily seen in the respective sociograms depicted in Figure 7 and 8. However, the partial networks differ in a great way: whereas in the directorship network power is rather less concentrated given a broad integration of FTSE-350 members, the structure of the ownership network is characterised as typical ego-centric network with a very small number of core actors holding nearly ninety percent of all interlocking ownerships, mostly in the role as a sender with rather small stakes. For this reason, any comparison of other descriptive measures is rather difficult.

Examining the underlying systematic logic of the governance structure in the British network structural tendencies regarding triadic microstructure of British firms can suggested. At first, it can be noted, that evidence has been found for local regularities in both, the interlocking directorship network and the interlocking ownership network. Thus, we suggest triadic structural components to play an important role for large British enterprises. The general hypothesis that interdependencies between interlocking directorships on the one hand, and cross-shareholding on the other hand, does exist, therefore, can be confirmed. Board-to-board relations and ownership ties show both dyadic and extra-dyadic patterns of interdependence.

With regard to the directorship network structural tendencies of British enterprises are generally seen in multiple interlocks, in particular, for reciprocity, 2-out-star and 2-in-star configurations, but, a lower probability for actors is suggested to tend to indirect control sending a manager to another firm's board. With respect to the second hypothesis, we suggest a rather weak but still a structural characteristic of the British directorship network to be hierarchical rather than equivalent structured. Instead, network architecture is characterised by a rather equal distribution of power within the British directorship network.

In contrast, the web of cross-shareholdings can be evaluated: although the use of the model with network data surveyed for the British interlocking ownership network is rather limited in terms of interpretation of parameter estimates, we can suggest the central argument of the British network of shareholdings to be ego-centric. Evidence has been found for any such structural tendency towards reciprocity, a relatively strong tendency for the 2-out-star configuration, and again a rather weak preference for the 2-mixed-stars structural pattern. Hypothesis 2 can not be answered from the coefficients referring to the ownership network.

4.4 Country Study: France

The French corporate governance structure can be characterised the following: The French CG system can be designated to an insider-oriented system with strong connections to the public sector, i.e. traditionally close connections between national institutions and private enterprises exist.[437] Similar to Germany there is a large preference for multiple directorships; a narrow relation can be emphasised towards the state.[438] The elite-based coordination mechanism, which tied the large firms to the state, provides the conditions for management autonomy from the state as well as from the stock market.[439]

With regard to France's corporate ownership structure three salient features can be stated: concentration of ownership, extensive family ownership, and the role of holding companies. French enterprises are frequently entangled in complex cross-ownership arrangement with each other, a situation which sheltered firms from hostile takeovers.[440] *La Porta et al. (1998)* argue on a balancing mechanism for the rather undeveloped legal protection of investors in France given the highly concentrated ownership structures in France;[441] however, ownership remains concentrated in the hands of individuals and families.[442] Although state and institutional investment in French companies, these parties do not play any major role in terms of management control of enterprises.[443] Likewise, the influence of equity markets in terms of control is rather low in France.[444] In France a large number of state enterprises are existent where there is no trade of the equity, known as „Noyau Dur" or „Actionnaires de Références". Historically, there is a weak capital and banking structure in France, consequently, until relatively recently, a significant reliance on self-financing which implies the concentration of ownership in

[437] See Charkham, J. P. (1994), p. 119.
[438] See Witt, P. (2003), p. 104.
[439] See Hancké, B. (2003), p. 207.
[440] See Hancke, B. (2003), p. 195 ff.
[441] See La Porta, R. / Lopez-de-Silanes, F. / Shleifer, A. (1998), p. 471.
[442] In France over the last three hundred years historical factors have produced a weak capital and banking structure. Because of these weaknesses there has been, until relatively recently, a significant reliance on self-financing. Self-financing in turn implies that ownership remains concentrated in the hands of individuals and families (see Murphy, A. E. (2004), p. 3).
[443] See Witt, P. (2003), p. 100.
[444] See Charkham, J. P. (1994), p. 147.

the hands of individuals and families.[445] There are many holding-company structures controlling large industrial groups in France, i.e. large industrial groups being tied together by financial holding companies.[446] Altogether, for the inter-firm network we expect a complex web of corporate relationships in France.

Throughout the study we refer to existent empirical results of network-analytic investigations of the French governance network found in literature, among others, for example, *Morin (1995)*, *Schmidt (1996)*, *Franks / Mayer (1997)*, *Bloch / Kremp (2001)*, *Hancké (2003)*, and *Witt (2003)*.

4.4.1 Sample and Data

The dataset captures the largest public stock corporations ($=N^F$) listed on the continuous or fixing segments of the Premier Marché, Second Marché and Nouveau Marché at Euronext Paris, which are the highest market capitalization in each economic sector.[447] The 2004 sampling frame included 250 corporations stock listed in the SBF-250[448] in the composition as of end of year 2004 (reporting date January 1, 2005).

A descriptive analysis of the French corporate network structure is carried out using the methodology of social network analysis; subject of analysis are interlocks between firms that form part of the sample (particularly the interlocking directorates and shareholder-crossings). Coefficients were computed for the total sample of 244 firms; we explored our hypothesis using data on networks consisting of 119 firms that had entered into the directorship network, and 109 firms with regard to the ownership network.

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[445] See Murphy, A. E. (2004), p. 5 f.

[446] Lévy-Leboyer (1980) explained the development of these large industrial groups tied together by financial holding companies as arising from banking and capital market limitations (see Lévy-Leboyer, M. (1980), p. 629).

[447] Throughout the study, the term 'company' or 'firm' is employed, always referring to a member of the SBF-250 Index.

[448] The SBF-250 is composed of the 120 companies listed in the SBF-120 (which includes the more famous CAC-40) plus further 130 listed companies from the continuous or fixing segments of the Premier Marché, Second Marché and Nouveau Marché at Euronext Paris. The SBF-250 is based on a sectoral economic nomenclature made up of three great sectors (valeurs industrielles / services / sociétés financières) classified into 12 economic sectors, which again are sub-classified into 38 industry sectors. Its sample is composed of the most capitalized values in each sector. See Euronext S. A. (2005), online.

For the purposes of this country study, data on board directorships was collected from the Annual Reports of the sampled firms for the year 2004 (as of 31.12.) restricted to directive directorships.[449] Data regarding social mandates (sociaux mandates) are collected only to such degree companies have specified these. Pursuant to Article L.225-102-1 of the Commercial Code, each listed firm must publish a report on all positions and offices held in any company by each of the company's directors (Mandats et Fonctions Exercés au Cours de l'Exercice) during the past financial year.

For a definition of interlocking directorships for our study on French companies the two different models of corporate governance firms can option for, must be considered, namely the Société Anonyme à Conseil d'Administration, a form of stock corporation with a single board of directors (one-tier system) and the Société Anonyme à Directoire et Conseil de Surveillance, a stock corporation with a two-tier management structure.[450]

For firms that can be assigned to the one-tier system we agree on the following definition: data on external, independent directorships within the meaning of the Bouton Report (sociaux mandates indépendant)[451] in other firms that could be assigned to the sample are collected executed by members that are not declared independent in the management board (Conseil d'Administration) of the respective firm.[452] For example: Jean-René Fourtou is PDG of Vivendi Universal S.A. and, at the same time, is an

[449] In some cases we collected the information from the annual report of the respective group company; in some cases we contacted the IR responsibilities of the respective company.

[450] There are numerous types of company structure which are provided for by French Law, however today the great majority of trading entities in France have taken the form either of a Société Anonyme (S.A.), or a Société à Responsabilité Limitée (S.A.R.L.). Traditionally, in France one can find the "Société Anonyme à Conseil d'Administration de Droit Français", a form of limited company under French law with one governance organ, the board of directors (le Conseil d'Administration). Instead, French corporations do have the option since 1966 to change their corporate form to a "Société Anonyme à Directoire et Conseil de Surveillance de Droit Français", with approval of the shareholders. The latter is a public company with a two-tier management structure pursuant to which an independent management board (le Directoire) manages the day-to-day affairs under the general supervision of a supervisory board (la Conseil de Surveillance). The one-tier system is regulated by the articles 98 ff. of the Loi sur les Sociétés Commerciales, the two-tier system by the articles 118 ff. For more see Dufey, G. / Hommel, U. / Riemer-Hommell, P. (1998), p. 55; Wymeersch, E. (1995), p. 314.

[451] La définition d'administrateur indépendant est celle donnée par le rapport Bouton: "Un Administrateur est indépendant lorsqu'il n'entretient aucune relation de quelque nature que ce soit avec la Société, son Groupe ou sa Direction, qui puisse compromettre l'exercice de sa liberté de jugement."

[452] French law does not contain any independence requirement for the members of the board of directors. The Bouton Report recommends, however, that at least half of the members of the board of directors be independent in companies that have a dispersed ownership structure and no controlling shareholder. The report states that a director is independent when "he or she has no relationship of any kind whatsoever with the corporation, its group or the management of either that is such as to colour his or her judgment" (see Bouton, D. (2002), p. 8 ff).

independent director (Administrateur Indépendant) of the management board (le Directoire) of Sanofi-Aventis S.A.;[453] Michel Pébereau is chairman of the management (Président du Conseil d'Administration) of BNP Paribas S.A. and holds a seat onto the supervisory board (Conseil du Surveillance) of Axa S.A.[454] Linkages between two independent directors or one independent director sitting onto the management board of one firm holding a mandate onto the supervisory board of another firm are neglected.[455] Directors that did not respond to the criteria of independence[456] are not collected as network data for the purpose of this study.[457]

For French firms of the type Société Anonyme à Directoire et Conseil de Surveillance the following definition regarding directorships is agreed upon: Data on external directorships of the members of the board (le Directoire) including the chairman (Président du Directoire) and, in addition, directorships hold by the chairman of the supervisory board (PCS) is collected. More precisely, independent directorships hold in firms of the type Société Anonyme à Conseil d'Administration or seats hold in the supervisory board of French firms of the type Société Anonyme à Directoire et Conseil de Surveillance. For example: Jean-Marc Espalioux, is chairman of the board of directors (Président du Directoire) of Accor S.A. and holds an independent directorship (Administrateur indépendant) onto the management board (Conseil d'Administration) of Veolia Environnement S.A.; Benoît Potier is chairman of management board (Président du Directoire) of Air Liquide S.A. and, at the same time, is an independent director (Administrateur independent) of Danone S.A. and holds a seat onto the supervisory board (Conseil de Surveillance) of Michelin S.A.

It should be noted, that the total number of directorships is exceedingly higher within the French directorship network taking also linkages between ordinary members of the supervisory board (Conseil de Surveillance) into account, or additionally members that can be assigned to other governance bodies, e.g. the "Comité Executive", "Comité de Direction Groupe"; thus, a more complex system of interlocks is assumed.

[453] Both firms can be assigned to the legal form a Société Anonyme à Conseil d'Administration.
[454] BNP Paribas S.A. constitutes of the form of a Société Anonyme à Conseil d'Administration, whereas Axa S.A. can be assigned to the type of Société Anonyme à Directoire et Conseil de Surveillance.
[455] With respect to the considered "governance perspective" taken in this study.
[456] See Bouton, D. (2002).
[457] For example: 2004 rapport annuel de BNP Paribas, p. 140.

When companies own shareholdings on other companies' ordinary share capital (Répartition du Capital), a complex system of interlocks develop that can be called ownership or capital network. Examples for such networks are the "Groupes Industriels" in France.

Most companies listed in the SBF-250 comment on their shareholder structure or on their major shareholders regarding the firms' ordinary shares (Structure de l'Actionnariat) as well as voting rights (Droits de Vote). For the purpose of this study data on direct and indirect capital ownership is collected as long as companies provided specified information on that. It should be noted that generally the share of voting rights are higher compared to shares on the ordinary capital.[458] Moreover, it should be noted that the full extent of cross-holdings in France is not publicly known, as cross-holdings are frequently subdivided so that they remain below the threshold levels that would imply mandatory publication.[459]

A detailed overview of the interlocking ties between the members of the sample defined in accordance with the definitions set out here is shown in the Appendix.

4.4.2 Descriptive Statistics

The number of interlocking directorates between members of the SBF-250 amounts 546,[460] here from a major part can be identified as multiple interlocks. With respect to our sample 20 2-directorships, two 3-directorships and one 4-directorship are identified; 12.30 percent of the SBF-250 members share two or more directors. A relatively high network density of $\Delta p = 0.921\%$ meant that 546 out of the 59,292 possible links among corporate actors are present in the French directorship network by the state of end of 2004.[461] The network density taking only linked firms into our calculation amounts $\Delta p^{l} = 3.888\%$;[462] more than half of the SBF-250 members are not linked to the

[458] For example, Eurazeo S.A. holds 3,66 % of the ordinary share capital of Danone S.A. and 7,16 % of voting rights (as of 31.12.2004).
[459] Listed companies need to declare holdings above the threshold of five percent under French law.
[460] See Table 11: Row 2.
[461] See Table 11: Row 8.
[462] See Table 11: Row 9.

directorship network.[463] Taking multiple directorships into calculation,[464] a density of $\Delta p^d = 0.875\%$ is computed.

An investigation of the structure of interlocks using measure of the actors' degrees reveals the following: the maximum outdegree observed among firms amounts 16 in the personal network, the median degree amounts 1.119 with a relatively high standard deviation; the maximum indegree amounts 12.[465] Thus, we suggest a relatively broad integration of enterprises in the network with a medium degree of concentration of power given a relatively low degree-based network centralisation.

Turning to the ownership network, from the descriptive measures the following can be stated: the number of cross-shareholdings between companies that form part of the dataset amounts 288,[466] which means a network density of $\Delta p = 0.486\%$. Nearly half of the SBF-250 members are embedded into the web of cross-shareholdings, without considering firms those remain unlinked to the capital network the network density amounts $\Delta p^l = 2.447\%$.[467]

To sum up, a relatively intense network of directorships is found for the French sample including nearly half of the members, whereby the ownership network is not as dense with a truly asymmetric distribution of power. However, a broad integration for both partial networks suggesting that interlocking is a favourable instrument in France. Interestingly, the degree of network centralisation indicating the broadness of actors' integration is comparably higher for the ownership network although the directorship network shows a higher number of interlocks. The concentration of power in the interlock network can be examined more comprehensively analysing the centrality degree of its actors.[468] From the descriptive measures hereon the suggested heterogeneity with respect to the ownership network might be supported. A large standard deviation for the outdegree indicates to a high degree of power concentration;

[463] See Table 11: Row 4.
[464] Sociometric data dichotomised.
[465] See Table 11: Row 7. Note that median outdegree=median indegree, as for simple graphs indegree=outdegree=total degree / 2 (see Freeman, L.C. (1979), p. 215 ff).
[466] See Table 11: Row 2.
[467] See Table 11: Row 8 and Row 9.
[468] See Freeman, L. C. (1998), p. 109 ff.

the low number of senders and a comparably high number of receivers, moreover, suggests an asymmetric distribution of control within the ownership network. For the directorship network a more equal ratio of the counts of senders and receivers is observed, and together with the descriptive measures on the actors' degrees a well-balance setting is concluded.

The principal findings regarding the structural features on the directorship network and ownership network are summarized in **Table 11**.

		France					
		Directorship Network			Ownership Network		
1	Number of firms that form part of the sample (=N^F)	244					
2	Number of interlock ties ($M^{F,P}$; $M^{F,C}$)	546			288		
3	Number of multiple interlocks[469] / direct corporate interlocks	23	519				
4	Number of Isolates / Linked firms (in % of N^F)	125 (51.23)	119 (48.77)		135 (55.33)	109 (44.67)	
5	Number of Sender / Receiver / Intermediaries	90	104	119	40	94	25
6	Degree-based network centralisation	0.004048			0.011840		
7	Centrality degree						
	- outdegree (Max. ($O^{F,P*}$; $O^{F,C*}$)/ Med. / StDev.)	16	1.119	2.129	27	0.593	2.623
	- indegree (Max. / Med. / StDev.)	12	1.119	1.861	4	0.593	0.900
8	Network density (overall) in %	0.921			0.486		
9	Network density (without unlinked firms) in %	3.888			2.447		

Table 11: Structural Features of the Partial Networks (F).
Note: Relative numbers are in parentheses.
Source: Own calculations based on empirical data.

Describing the configuration of the network adjoined to the core-periphery-model (*Borgatti / Everett, 1999*),[470] we could draw some conclusions on the appearance of the partial networks. For visualisation, the sociograms for the directorship and the ownership network are depicted in **Figure 12** and **Figure 13**, respectively.

[469] Relevant only for the directorship network.

[470] The approach taken here does not follow the work of Borgatti / Everett (1999) in the case that we used a rather intuitive way of individually setting the core members as a set of actors that are significantly higher embedded within the network measured by the individual actors' sum of in- and outdegree. In contrast, Borgatti / Everett (1999) simply partitioned the actors into core and periphery classes by the criteria that the core is a complete subgraph and the periphery is a collection of actors that do not interact with each other.

For the SBF-250 we can identify a group comprising of eleven corporate actors forming the core of the directorship network.[471] The degree-centrality of these firms amounts relatively higher than all others (on average): with regard to the outdegree, the figure calculated on the members of the network core amounts to 0.031. In other words, 7.6 representatives per actor on average are delegated to other members of the SBF-250. With regard to the indegree, this coefficient amounts 0.027 or 6.6 seats on the body of the respective firm are held by other members. Thus, no clear statement for the aggregate core members can be made regarding any dependency of them to the periphery. With regard to all actors within the defined network the figures are 0.005 (1.1 managers).[472] Two players assigned to the core have a significantly higher sum of degrees: BNP Paribas S.A. and AXA S.A., both playing a dominant role in the network with regard to their centrality degree.

Examining the ownership network with respect to a core-periphery structure five stable groups of cross-shareholdings are identified, each constructed around a major bank and a large insurance company: the first has the Banque Nationale de Paris (BNP) Paribas, the Société Générale, and Credit Agricole at its core, the other the insurance companies Assurance Générales de France (AGF) and AXA.[473] The results are in accordance with those of *Morin (1995)* who also counts these firms among others to the core of network.[474] Together, these financial cores had direct and indirect controlling stakes in each other and a large number of publicly quoted large companies listed in the SBF-250. Additionally, with respect to our sample *Morin (1995)* suggested the holding company Suez; this particular actor is not strongly embedded, thus in contrast to *Morin (1995)* cannot be assigned to be a core player in the ownership network.

[471] For the purpose of the particular sample, firms are defined as being a member of the core of the directorship network if the sum of their respective indegree and outdegree amounts higher than ten.
[472] For simple graphs indegree=outdegree=total degree / 2.
[473] The criterion is set to be the sum of their degrees amounting ten or more.
[474] See Morin, F. (1995), p. 427 ff.

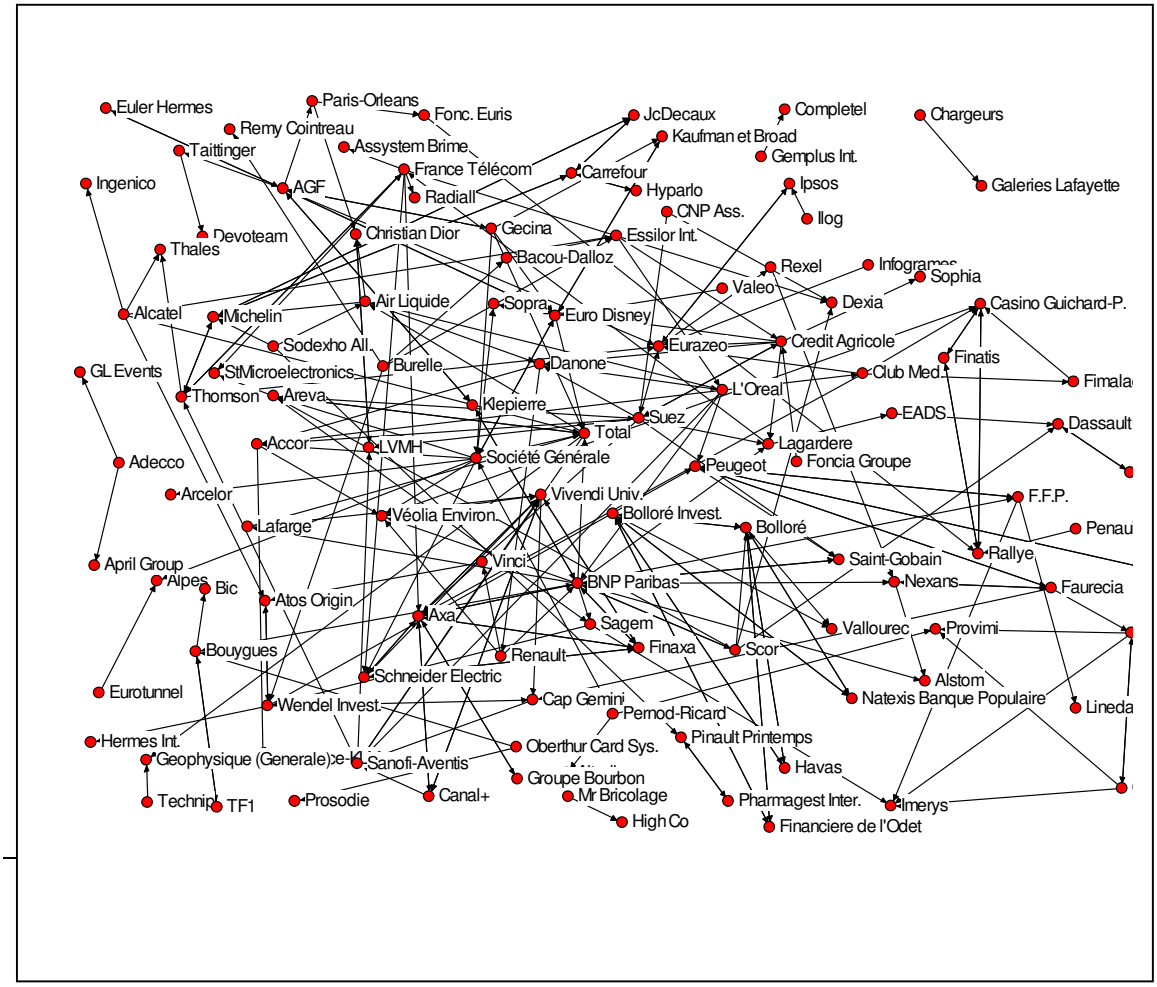

Figure 12: Sociograph for the Personal Network (F).

Note: Illustration without isolated actors.
Source: Sociograph developed with NetDraw [475], Version 2.17, based on surveyed network data (dichotomized).

[475] NetDraw is a program for drawing social networks. NetDraw is free and may be freely distributed. For more information about the program, contact its author, Steve Borgatti, at steve@analytictech.com or +1 978 456 7372.

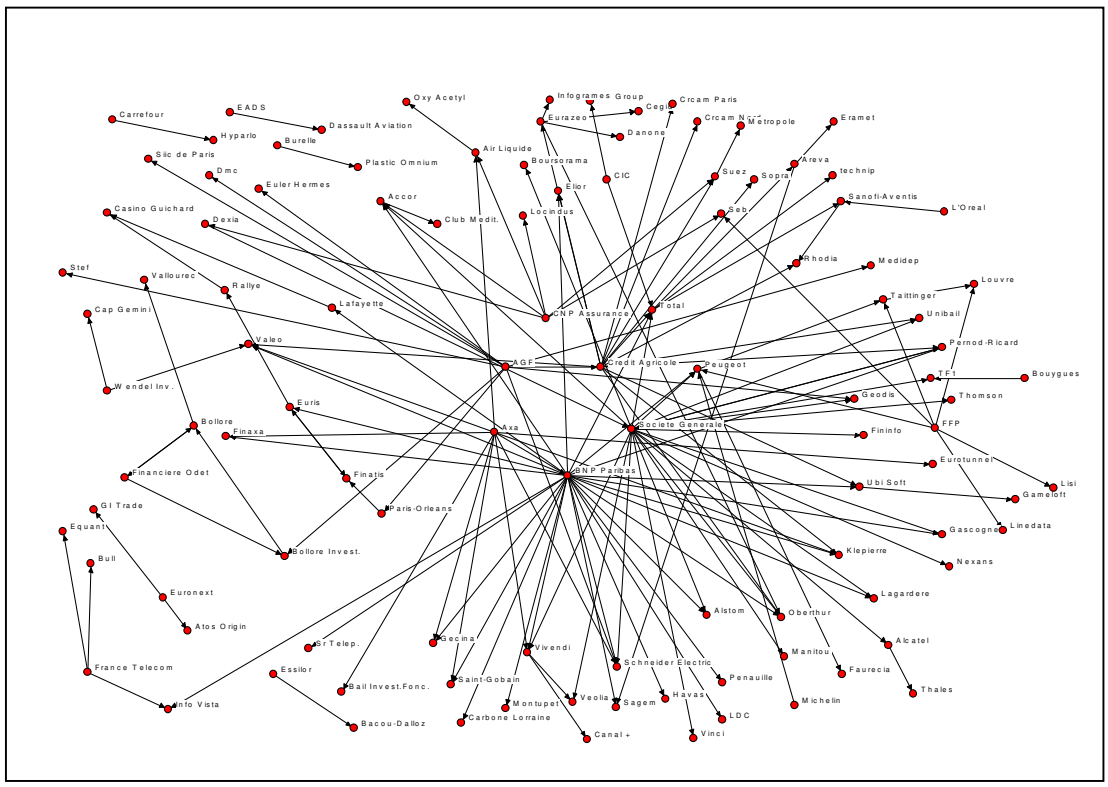

Figure 13: Sociograph for the Ownership Network (F).
Note: Illustration without isolated actors.
Source: Sociograph developed with NetDraw [476], Version 2.17, based on surveyed network data (dichotomized).

From the distribution of directorships depicted in **Figure 14** the argument of *Witt (2003)* becomes evident: There is a high tendency of French firms for multiple directorships, similar to Germany.[477] This can be seen from a large number of French enterprises with a number of directorships of two and more.

[476] NetDraw is a program for drawing social networks. NetDraw is free and may be freely distributed. For more information about the program, contact its author, Steve Borgatti, at steve@analytictech.com or +1 978 456 7372.
[477] See Witt, P. (2003), p. 104.

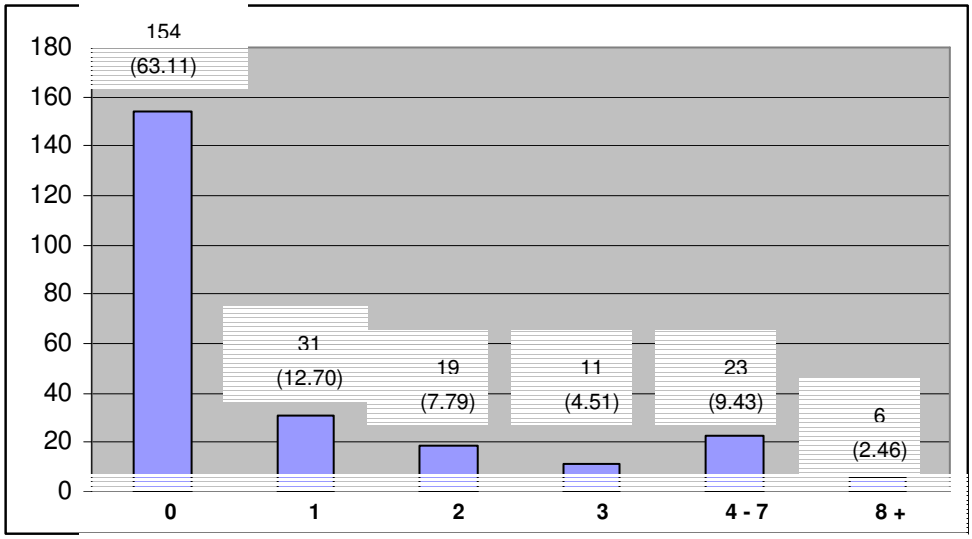

Figure 14: Distribution of Directorships per Actor (measure: outdegree) (F).

Note: Relative numbers are in parentheses.
Source: Based on empirical network data.

Examining the ownership concentration, we could derive statements regarding the strengths of potential influence and control of owners in the capital network. **Figure 15** demonstrates the distribution of share ownership concentration. Obviously, the distribution is just as one would expect: the higher the ownership stake held, the lower the number of actors is identified within the SBF-250 sample. Thus, we follow a relatively dispersed ownership structure with respect to cross-shareholdings between SBF-250 members.

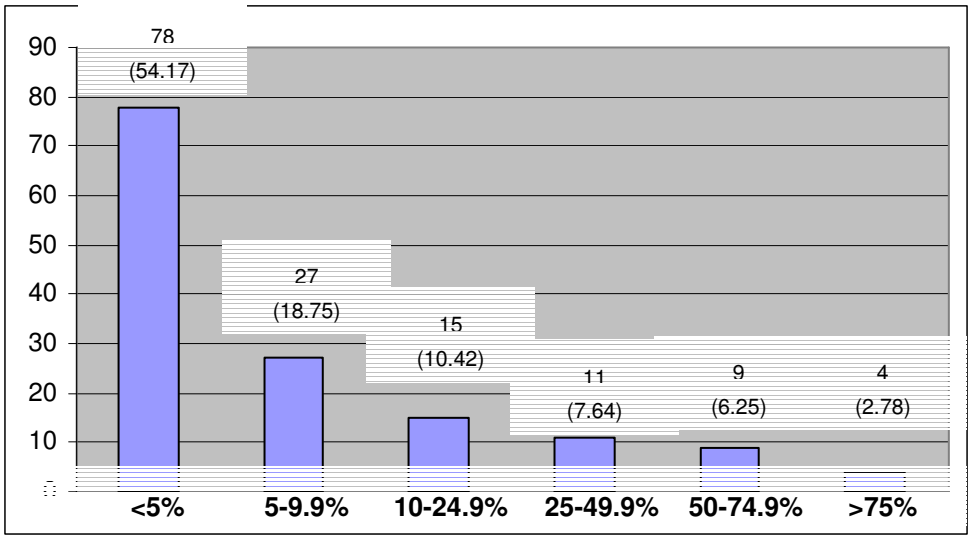

Figure 15: Degree of Ownership Concentration (Proportion of Stock Owned in %) (F).
Note: Measure is the outdegree. Relative numbers are in parentheses.
Source: Based on empirical network data.

Figure 16 demonstrates the structure of cross-shareholdings for the ownership network. Interestingly, a high concentration of dominant cross-shareholdings on a small number of corporations can be suggested (sender firms) given more than twice as many receiver firms. Thus, evidence for a broad integration can be seen.

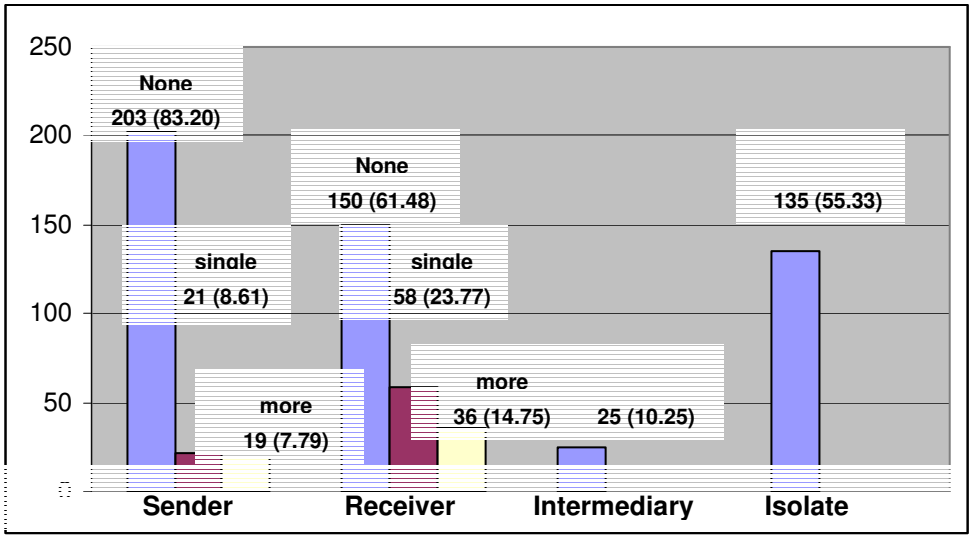

Figure 16: Structure of Cross-Shareholdings (F).
Note: Measure is the outdegree. Relative numbers are in parentheses.
Sender: no participation (none), one participation (single), more than one participation (more);
Receiver: no owner (none), one owner (single), more than one owner (more).
Source: Own calculations based on empirical data.

Given the broad integration of firms into both partial networks respectively, some degree of overlap between the two partial networks can be assumed. In fact, from the survey network data a great degree of overlapping is observed: in total 43 cases are observed; interestingly, often multiple directorships are combined with ownership ties. However, no clear tendency regarding the size of the share stake and parallel holding a mandate in one particular firm can be suggested based on the surveyed network data for the SBF-250 sample.

Again, a more comprehensive analysis on the underlying systematic of the pre-defined SBF-250 network reveals more information about the governance network, especially with regard to position and power of actors within the respective network. A discussion around the empirical results of a discrete, uni-variate analysis regarding the triadic microstructure in both partial networks described here will be presented in the following chapter.

4.4.3 Empirical Results

The discussion of p* that follows center around the French directorship network of 119 linked firms and the German ownership network of 109 linked firms, respectively assigned to our defined dataset, the SBF-250, whose directed graph appears in Figure 15 and Figure 16, respectively.

The triad census in **Table 12** reveals the counts of the triads with its 16 components classified in Chapter 2.4 found in the SBF-250 network, respectively for the directorship and ownership network. Given our sample comprising 244 members $\binom{244}{3}$=2,391,444 triads are possible in the network. From the table we follow some triadic behaviour of the SBF-250 members with respect to both forms of institutional linkages.

		Triad Census	
No. of Arcs	Network Configuration	Directorship Network	Ownership Network
0	τ_0	251,481	195,822
1	τ_1	16,295	12,856
2	τ_2 ; τ_3 ; τ_4 ; τ_5	5.251 ; 96 ; 184 ; 202	293 ; 52 ; 769 ; 103
3	τ_6 ; τ_7 ; τ_8 ; τ_9	11 ; 1 ; 125 ; 103	11; 0 ; 22 ; 5
4	τ_{10} ; τ_{11} ; τ_{12} ; τ_{13}	46 ; 8 ; 4 ; 0	0 ; 0 ; 0 ; 1
5	τ_{14}	3	0
6	τ_{15}	9	0

Table 12: Triad Census (F).
Note: The sixteen types of triples are presented in the no. of arcs present.
Source: Pajek[478]-report reading network data.

Figures from Table 12 lead to the conclusion that some triadic behaviour of the SBF-250 members is present in the French governance network. In the following, the p* results for the triadic analysis are presented next. **Table 13** lists the models with parameters estimated specified and the goodness of fit for each model, respectively.

[478] A program developed by Vladimir Batagelj (Department of Mathematics, FMF, University of Ljubljana, Slovenia) and Andrej Mrvar (Faculty of Social Sciences, University of Ljubljana, Slovenia) for (non-statistical) analysis and visualization of large networks. The latest version of Pajek is freely available, for non-commercial use, at its homepage: http://vlado.fmf.uni-lj.si/pub/networks/pajek.

	Goodness-of-Fit for p* Model			
	Directorship Network		Ownership Network	
Level (=No. of model parameters)	$-2L_{PL}$	$-LR_{PL}$	$-2L_{PL}$	$-LR_{PL}$
1 (τ_1)	1,554.947	42.465	1,425.263	14.795
2 ($\tau_1 - \tau_2$)	1,512.482	21.271	1,410.468	259.421
3 ($\tau_1 - \tau_3$)	1,491.211	15.237	1,151.047	4.401
4 ($\tau_1 - \tau_4$)	1,475.974	26.795	1,146.646	0.058#
5 ($\tau_1 - \tau_5$)	1,449.179	67.671	1,146.588	0.270#
6 ($\tau_1 - \tau_6$)	1,381.508	0.001#	1,146.318	0.142#
7 ($\tau_1 - \tau_7$)	1,381.507	13.547	1,146.176	0.132#
8 ($\tau_1 - \tau_8$)	1,367.960	1.423	1,146.044	1.222
9 ($\tau_1 - \tau_9$)	1,366.537	0.600#	1,144.822	0.022#
10 ($\tau_1 - \tau_{10}$)	1,365.937	0.209#	1,144.800	0.154#
11 ($\tau_1 - \tau_{11}$)	1,365.728	58.372	1,144.646	4.296
12 ($\tau_1 - \tau_{12}$)	1,307.356	0.973#	1,140.350	0.483#
13 ($\tau_1 - \tau_{13}$)	1,306.383	17.426	1,139.867	0.000#
14 ($\tau_1 - \tau_{14}$)	1,288.957	0.459#	1,139.867	0.000#
15 ($\tau_1 - \tau_{15}$)	1,288.498	-	1,139.867	-

Table 13: Fit Statistics for p* Model (F)

Note: The first parameter in each model is the intercept term. A stringent of $\lambda_P = 0.0001$ and $\lambda_C = 0.0001$ is used, respectively. '#' indicates parameters whose absence does not change the pseudo-likelihood deviance substantially.

Source: Own calculations based on network data.

Accordingly, the fitted Markov random graph model for the SBF-250 directorship network comprising all parameters of model 5 plus the parameters τ_7, τ_8, τ_{11}, τ_{13}. The coefficients are demonstrated in **Table 14**. Estimation results of respective parameters for the best-fit model[479] with respect to the ownership network comprising five parameters are shown in **Table 15**, discussed thereafter. Remember, if there is a positive value for the Pseudo-likelihood estimation we follow that the conditional probability

[479] Model which has the lowest "badness-of-fit".

that the particular configuration is existent in the network is higher than the conditional probability that it is not existent (ceteris paribus); vice versa for a negative value.[480]

	p* Model for the Directorship Network		
Network Parameter	β	*Wald – Statistic*	$\exp(\beta)$
τ_{1_P}	-5.7733	1,072.8737	0.0031
τ_{2_P}	4.0198	49.5779	55.6894
τ_{3_P}	0.2270	13.0554	1.2548
τ_{4_P}	0.1676	4.3144	1.1825
τ_{5_P}	0.2652	30.1134	1.3036
τ_{7_P}	0.2232	0.3175	1.2501
τ_{8_P}	-0.4053	11.6333	0.6668
τ_{11_P}	-0.3385	0.1307	0.7128
τ_{13_P}	-0.4558	0.9260	0.6339

Table 14: p* Model for the Directorship Network (F)
Note: Parameters for the best-fitting (has the lowest "badness-of-fit") excluding parameters appointed to be "unimportant".
Source: Own calculations based on empirical data.

At first, from the table it becomes evident that besides dyadic also triadic behaviour of the SBF-250 members is prevalent in the network. One can see that there is certainly a tendency for relational ties that increase reciprocity and also the three types of stars which occur for a directed relation (2-out-stars, 2-in-stars, 2-mixed-stars), and cyclic triads to increase the log odds, and hence to be more likely to be present. Ties that increase the other statistics are less likely to be present.

A high structural tendency towards reciprocity can be suggested, i.e. French enterprises prefer to be reciprocally linked sending managers to each other. No hierarchical tendency for the French directorship network is suggested; the respective parameter for cyclic structural patterns is positive. The parameter estimate for transitive triads is not contained in the model; this might give support to the statement.

[480] See Chapter 3.3.

	p* Model for the Ownership Network		
Network Parameter	β	*Wald – Statistic*	$\exp(\beta)$
τ_{1_C}	-5.2829	1,030.4882	0.0051
τ_{2_C}	1.7468	5.6877	5.7361
τ_{3_C}	0.1661	307.6836	1.1807
τ_{8_C}	-0.0096	0.0445	0.9904
τ_{11_C}	-0.0220	0.0081	0.9782

Table 15: p* Model for the Ownership Network (F)
Note: Parameters for the best-fitting (has the lowest "badness-of-fit") excluding parameters appointed to be "unimportant".
Source: Own calculations based on empirical data.

On the dyadic level it becomes obvious, that there is rather low structural tendency for French enterprises to opt for isolated, single-directed directorships. The respective parameter estimate for τ_{1_C} amounts highly negative; i.e., the French ownership network is characterised by low existence of isolated social circles but rather actors tend to opt for multiple interlocks. A high coefficient for configuration τ_{2_C} together with a large likelihood ratio - respectively from Model 1 to Model 2 - suggest reciprocity to be highly preferred structural configuration in triadic microstructure of French enterprises. The figure stated in column four with respect to the reciprocity parameter can be interpreted the following: as the number of reciprocal dyads involving the tie from actor i to actor j increases by one, and the other explanatory variables remain constant, the odds that i sends a tie to j increase by a factor of $\exp(\beta) = 5.7361$.

Some tendency for relational ties that increase 2-out-stars to increase the log odds, and hence to be more likely to be present can be stated. Ties that increase the other statistics, not mentioned here, consequently, are less likely to be present.

4.4.4 Summary

This country study focuses on the analysis of the French corporate network, for the purpose of this study established by interlocking directorates and capital linkages between large French enterprises. Based on the descriptive measures assigned to the

social network analysis on the surveyed network data, a number of statements can be drawn:

Evidence is found for a densely interlocked network with large preference for multiple directorships and a broad integration with respect to the SBF-250 sample. Thus, we suggest a persistent demand of information and control of firms over others within the French governance system. However, no clear core members are identified who are dominant within the directorship network. In contrast, with respect to the French ownership network, a high degree of power concentration can be suggested, thus a rather asymmetric distribution of control identifying a core within the visualized network structure. For the total interlock network evidence has been found for a great degree of overlap.

Examining the triadic microstructure for French enterprises within the respective partial networks the following findings can be summarised:

Evidence is found that besides dyadic also some tendency towards triadic behaviour of French enterprises is found. Thus hypothesis 1 can be confirmed; i.e., individual IORs within the French governance system are not independent from each other. For the directorship network hypothesis 2 can be rejected, no statement can be made with regard to the ownership network.

5 CONCLUSION

This paper examined the governance systematic in inter-firm networks of Europe's largest network economies allowing the author to draw conclusions on the corporate behaviour and strategy in respective social systems. In particular, the study explored the triadic structural tendencies of the largest corporate actors forming governance networks in Germany, France and the United Kingdom from an inter-organizational perspective. The objective thereby is to enhance transparency in the corporate governance landscape and to find out whether distinguishing corporate governance systems can be related to different structural tendencies in governance network systematic assigned to a particular corporate behaviour and strategy of the economy's largest enterprises. The starting hypothesis was that inter-firm relationships of certain types identified within the respective corporate networks are interdependent to each other. The idea was that enterprises aim for optimizing their individual microstructure, i.e. their respective set of relationships. Moreover, this study provides comprehensive descriptive readings regarding the empirical mapping of patterns of social relations existent in the three major European economies.

Given that most research on this topic has focused on the structural characteristics of corporate networks from a descriptive way of studying the connective topography between interlocking corporate organisations, interestingly in this study a hypothesis-testing model is employed for a more comprehensive investigation of the complexity of the network structure beyond the dyadic level of analysis as well as its multi-causal logic. This allows obtaining a wider perspective on this issue picturing the systematic, i.e. the structural logic of corporate relationships and resultant impacts. In short, the purpose of field research was to obtain a depth of understanding of the systematic of corporate interlocks.

5.1 Main Contributions of the Study

The research reported from the individual country studies has its origins in the inter-organizational perspective. The network data included in this study allows us to address a number of hypotheses with regard to the microstructure, from the descriptive measures conclusions can be drawn with regard to the macrostructure.

The implication of the work reported in the study is that an adequate understanding of the power structures in countries varies as national variations in economic circumstances may have influenced the emergence of interlocks. This exploratory study has used a research method that allows researchers to better understand the complexity of the system of inter-firm relations examining the tendencies of triadic microstructure of firms testing hypotheses relating to this issue.

The current study produced also important methodological findings. The combination of tools that could be assigned to social network analysis with a quantitative probability model in order to estimate the prevalence of network configurations enables the Reader to get a more comprehensive picture of the corporate networks in the countries. The study makes methodological contribution in using *Wasserman / Pattison's (1996)* p* model to examine network structural tendencies that are difficult to study using traditional social network analysis approaches hereby demonstrating the feasibility and utility of triadic analysis in inter-corporate networks. However, methodological developments such as p* are only fruitful to management scholars if coupled with theoretical hypothesis that will be tested regarding the investigation of structural tendencies within networks. Network scholars have suggested the network perspective could provide a more complete and comprehensive understanding of firm competitive behaviour,[481] thereby linking network systematic and competitive behaviour. Little research has actually conceptualized network moves themselves as competitive actions. Some of the results from this exploratory study regarding the competitive implications of triadic structure can be used to research systematically network actions as competitive behaviour.

5.2 Discussion of the Empirical Results

Two rather general questions are standing behind the research of this study: how are social structures in the major European network economies formed; and how is corporate (economic) power distributed in the respective governance networks? The

[481] See Smith, K. G. / Ferrier, W. J. / Ndofor, H. (2001), p. 347.

aim of this particular study was to find answers to the following research questions as set out in section 1.1.2:

- What structural tendencies in triadic microstructures can be observed in the respective institutional networks of corporate power in the countries of interest and what are their implications?
- How can actors' inter-firm behaviour regarding dyadic and triadic formation be interpreted given the main characteristics of the respective corporate governance system?

During the descriptive analysis it has become apparent that the overall structures of the national inter-corporate networks are shaped quite differently. From the empirical results a different underlying systematic logic of the respective network can be followed. Thus, with respect to the microstructure we conclude on different corporate behaviour in this regard; with regard to the macrostructure we conclude on players acting in different network environments.

The major research question was to investigate whether particular network configurations (local sub-graphs) are important in determining structure among actors pertaining to the national sample.

At first, two rather general statements can be made based on our empirical findings:

- Corporate behaviour and strategy of the economy's largest enterprises regarding are different with regard to their structural tendencies in systematic logic.
- More complex network configurations are less probable to occur over all networks.

The major findings answering the hypotheses set up at the beginning of this work are:

- The general hypothesis can be confirmed for all network economies studied that within the respective governance networks interdependences between the interlocks do exist, which goes beyond the dyadic level. The prevailing personal and capital networks for the respective countries exhibit respectively both dyadic and extra-dyadic interdependencies over all countries. However, as

expected, differences can be stated regarding the level of complexity within the respective partial networks of a network economy as well as between the various countries.

- With respect to the second hypothesis as outlined in Chapter 1.3.1 different answers may be given with respect to the three network economies as well as the two types of interlock networks. In particular, for Germany's directorship network evidence is found to be of any hierarchical character whereas no clear statement can be made for the ownership network; same is found for the British governance network. For the French network of interlocking directorates hypothesis 2 has been rejected, no suggestion can be made for the network of ownership ties.

However, like in all empirical studies the measures have to undergo critical validation. Thus, evidence found and conclusions made must be treated carefully. With regard to the descriptive statistics on the network data the following has to be taken into account: in social network analysis, we are used to calculating descriptive statistics for networks, but not so used to accompanying these statistics with standard errors. Yet the general arguments for the benefits of standard errors do apply to social network analysis: it is useful to have an indication of how precise a given description is, particularly when like in our case making comparisons. The question in this case can be posed like this: is the level of interlock (i.e., the density of ties) different in two countries? Standard errors and statistical tests are inevitably based on considerations that the data - in our case, the network - "could have been different". These differences could occur because of observation errors, unreliability of measurement, the contingent - or probabilistic - nature of the processes that gave rise to the observed relations, sampling of vertices, choice of the observation moment, and many others. The problem is that there are no established, widely applicable, ways of calculating standard errors for network statistics. For example, *Snijders / Borgatti (1999)* have proposed non-parametric standard errors and statistical tests to network data. However, they ended up with mentioning that the basis for non-parametric standard errors and probabilities is mainly intuitive; but still, it is reasonable to use their proposed techniques, "since there are no alternatives in the general case, and it is better to have a rough impression of the

uncertainty or variability associated with observed network statistics than none at all."[482]

Critical discussions and limitations of the empirical findings from the research model employed in this study can be made. At first, it would be interesting to see the research devoted to its reliability. Therefore we hope that especially logit models will be applied widely by network analysts. Some arguments regarding the research design of this work will be outlined and implications for further research will be made in the following section.

5.3 Implications for Further Research

There are a number of limitations to the study. However, the current research can be well used as a base for future studies in order to get a more comprehensive understanding of a realistic picture of inter-firm networks. The ultimate question in management science is about corporate behaviour and strategy in network formation, and whether networks assist or impede economic performance from a macro- or micro-perspective. Implications for further research can be seen in:

- Does any systematic examination of the actors' microstructure on a higher level might reveal any competitive implication with regard to the corporate's interlock behaviour?

In the study presented the focus is on the uni-variate, dichotomous situation. Several extensions of this type of model could be worth further investigation. It may be fruitful to examine the governance network including other types of relations as well as valued relations providing a more comprehensive understanding to the underlying structural logic of the governance system. *Wasserman / Pattison (1999)* describe some of these extensions to valued and bi-variate relations. For example, in the latter case for $r = 2$ we obtain 137 parameters, which can be shown to correspond to 139 different triads in directed graphs. More generally, further extensions, away from the conventional one-mode analysis of relational, adjacency data moving towards model analyses of multiple networks involves a complementary broadening of approach. The respective p* model

[482] See Snijders, T. A. B. / Borgatti, S. P. (1999), p. 169.

used makes it possible to perform multi-level analysis (*Contractor / Wasserman, / Faust, 2003*). *Koehly / Pattison (2005)* build on simpler, uni-variate p* models, they make a generalization to random graph models for multiple networks using dependence graphs. They examine both actual relations and cognitive perceptions of these relations among managers in high-technology industries, showing that the multiple network methods lead to conclusions that simply would not be apparent in a conventional single network approach. This can be seen as one step toward richer models of generalized relational structures.

More complex models, involving longer paths, higher order configurations, and setting structure, have also been developed; for example, *Pattison / Robins (2002)* and *Snijders et al. (2004)*. By using more complex models in which 3- or 4-star configuration counts are used, i.e., the model incorporates the first three or four moments of the degree distribution; a more realistic model is produced rather than the present, rather trivial approach. Other extensions of the approach used here might be also fruitful, such as involving node attributes.

Future research could extent our focus examining endogenous and exogenous factors influencing the structural tendencies; for example *Contractor / Wasserman / Faust (2003)* and *Madhavan / Gnyawali / He (2004)*. I.e., what factors influence the likelihood of various network moves, or what factors drive firms' network moves.

- How structural tendencies over time, i.e. past trends, might give evidence for future development, and, have there been any changes within a pre-defined period of analysis?

The analysis of social networks over time has long been recognized as something of a Holy Grail for network researchers.[483] It may be fruitful to examine the governance networks with regard to their systematic configurations from an historical perspective. This issue might be particular interesting for the following reasons. Changing global preconditions may have contributed to a common alteration and adaptations of these inter-firm webs. The changes in the international environment have triggered profound transformations in the preferences of national actors who have become increasingly trans-national and in the power relationships at the national level. Thus, attention should

[483] See Wasserman, S. / Scott, J. / Carrington, P. J. (2005), p. 6.

be granted to the evolution of (global) corporate networks induced by changes in competitive conditions.

In this context, *Snijders (2005)* reviews the quest on models for longitudinal network data. He indicates interest in longitudinal questions about social networks is rising. In particular, he examines ideas of network evolution, in which change in network structure is seen as an endogenous product of micro-level network dynamics. In his actor-oriented model - he concludes on this particular to offer the best potential - actors are seen as changing their outgoing ties (choices), each change aiming at increasing the value derived from a particular network configuration. A series of such rational choices means that small, incremental changes accumulate to the point at which substantial macro-level transformation of structure occur. He concludes with the intriguing suggestion that such techniques can usefully be allied with multiple network methods such as those discussed by *Koehly / Pattison (2005)*.

- What are the implications with respect to trans-national interlocking networks?

National interlock networks have been analysed from a historical and comparative perspective many times with respect to European countries and beyond, however, given all the trends of merger of markets not only in Europe fewer work could be found on the analysis on international and trans-national networks[484]. The ultimate question here is whether networks assist or impede economic performance and if trans-national networks create economic interdependence among nation-states.

- Evidence from empirical studies on Central and Eastern European (CEE) with respect to the particular issues we examined in this study may lead to more necessary transparency in regional corporate landscape for better investment climate regarding foreign entities.

Less research with empirical evidence on interlock networks has been conducted in the CEE region from the background of CG. Systematic comparison of emerging CG patterns in CEE has long been constrained by lack of consistent and comparable data

[484] Such networks constitute business structures above the national level which cement the different national systems into an international structure.

across CEE countries, particularly at the micro level, and by the dynamic nature of institutional reform in post-communist transformation.

The importance of the topic of current work is evident in the fact that local governance is currently transforming to global governance. In academic literature it is widely discussed whether regional governance gives way to global governance or rather represents a handicap, whether regional integration in corporate networks hinder multilateral world trade and whether strategic corporate behaviour forming corporate networks raise global competition. How this process will go on will be interesting to analyse in future studies.

SUMMARY

Today, the modern economy is characterised by a growing dynamic and a high level of globalisation, integration and deregulation. In an increasingly interconnected and interdependent world with globalisation of markets, production and sources enterprises are becoming deeply intertwined with each other. There is an increasing acknowledgment that organizations typically operate in a relational context of environmental interconnectedness and that an organization's survival and performance often depend critically upon its linkages to other organizations.

Thus, the question behind all that could be raised is the following: Do firms organized in networks have higher survival chance than do firms which maintain arm's length market relationships? The ongoing globalisation process not only in the "European networked economies" might give support to this statement resulting in intensified competitive conditions in a more global competitive market. As the economies of the world become more and more globally integrated, these are the kinds of issues we can expect to face in striving to understand the interweaving system of corporate relations establishing formal as well as invisible networks of power.

To approach these questions, this study adopts the perspective and methodology of inter-firm network research. The purpose of this work is to explore the underlying structural logic of pre-defined governance networks prevalent considering the total corporate landscape respectively in Germany, France and the United Kingdom. The aim is to find answers to the following two research questions: how is corporate (economic) power distributed in the governance networks in major European countries; in other words, how are firms in network economies in Europe with different models of corporate governance operating organised and governed; secondly, what structural tendencies in triadic microstructures can be observed in the respective institutional networks of corporate power in the countries of interest and what are their implications; and thirdly, how can actors' inter-firm behaviour regarding dyadic and triadic formation be interpreted given the main characteristics of the respective corporate governance system. The analytic examination of the different network configurations reveals the degree and direction of the individual participant's network integration, thus power constellations within the governance networks in the selected countries are made more transparent.

Institutional networks, that is networks of interlocking directorates and ownership links are supposed to be a major element of European Corporate Governance, especially in network economies such as Germany, United Kingdom and France. By this mechanism, a structure of control is established in the corporate interlock network, long time being less transparent. However, recent regulations and recommendations regarding sound Corporate Governance set up by a number of private organisations or respective government committees in mainly all large industry nations have deepened this field of research to (mainly) academics allowing them to collect full systematic data to comprehensively analyse the structure of interlock webs.

Following popular and academic conventions, we define a dataset to be a specific number of large publicly held business corporations in the particular economy at a given survey date. For Germany we considered all enterprises listed in the Prime All Share-Index for the dataset thereby capturing captures the largest public stock corporations ranked by market capitalisation listed in the German Prime Standard segment in the composition as of end of year 2004. For the United Kingdom the FTSE-350 constituents as composed by end of 2004 were selected as listed at the London Stock Exchange. This Supersector Indice is the aggregation of the FTSE-100 which represents the 100 most highly capitalised blue chip companies and the FTSE-250 comprised of mid-capitalised companies, together representing approximately 95% of the UK market capitalisation. In France we opted on companies listed in the SBF250 index as of end of 2004. This dataset captures the largest public stock corporations listed on the continuous or fixing segments of the Premier Marché, Second Marché and Nouveau Marché at Euronext Paris, which are the highest market capitalization in each economic sector. By this means we may get a representative sample for the respective corporate market for our studies in terms of power relations existent in these three network economies.

A key goal in the triadic analysis that is conducted is to understand why certain patterns of tie formation occur and, in particular, to understand what the likelihood of observing triadic network configurations is and what factors explain their occurrence. In graph-theoretic terms, this approach implies discerning structural tendencies in observed networks. This approach seems reasonable in terms of a full description of the network system given the fact that the commitment and maintenance of personal and capital relationships between actors are not independent. Studies with regard to only one

type of relationship might comprise only constrained statements. We particularly argue that interdependencies between ownership ties exist as well as between the exertions of personal control. In short, the individual inter-organizational relations within a governance system are not independent from each other. I.e. the decision whether a company enters into a power relation with another company by the delegation of a manager or interlocking ownership depends substantially on existent further relations of both enterprises to each other.

We propose that tendencies in triadic microstructure reveal conclusions about the corporate inter-firm behaviour and strategy with respect to the firms' dyadic and triadic formation and competitive implications here from, as well as social influence and social selection within the defined samples, given the distinguishing characteristics of the respective corporate governance system. The ultimate question in management science that could be assigned to this work is about corporate behaviour and strategy in network formation, and whether networks assist or impede economic performance from a macro- or micro-perspective.

We test for non-randomness in inter-organizational network data using the recently developed log-linear statistical network model p* *(Wasserman / Pattison, 1996)*, which facilitates a more sophisticated understanding of the underlying structural logic - the triad microstructure - of the interweaving system of corporate control existent between a set of enterprises. The advantage of this class of probabilistic models is that they model global network structure as the outcome of processes occurring in local social neighbourhoods of the network.

From a theoretical perspective supported by simple plausible arguments two hypotheses can be set up: since network governance needs to be achieved across the entire network we would expect the interdependence of corporate ties to take forms that are not simply dyadic but rather interlocking directorates and interlocking ownership are likely to show both dyadic and extra-dyadic patterns of interdependence (Hypothesis 1). Moreover, since institutional interlocks are eventually hold for the purpose of the influence and control, a hierarchical character might be supposed from the structural tendencies of enterprises in microstructure, understood as an actors' strategic embeddedness by the means of his individual arranged inter-firm relations (Hypothesis 2).

Further issues that can be derived by the use of predictor variables in exponential random graph models are aspects of social influence and social selection within the pre-defined network. This paper attempts to shed light on these issues by describing in detail the important characteristics of the corporate networks established by the major corporate players in Germany, the United Kingdom, and France as well as examining the network systematic prevalent in those networks – in particular, the likelihood of observing triadic network configurations is estimated – in order to analyse corporate (network) governance. The empirical results reveal conclusions regarding corporate behaviour and corporate strategy, more precisely, the actors' inter-firm behaviour with respect to dyadic and triadic formation, social influence and social selection and competitive implications of triad structure for the respective samples given the respective characteristics of the distinguishing corporate governance system.

Given that both theoretical interest in governance in inter-firm network triads and the log-linear statistical model we employ in particular are relatively recent, we sought to demonstrate their joint utility and potential promise by using network data drawn from large enterprises of European network economies.

In the following, the empirical findings are presented in short for each country study.

With respect to the German corporate landscape evidence could be found that there is a persistent demand of information and control of firms over others. The total network is characterised by an extensive and dense network of corporate relations with a large number of German corporations integrated. Thus, a complex of interweaving corporate interlocks between a set of firms within the Prime All Share Index is observed. The German corporate network is primarily determined by the pattern of its interlocking directorships, i.e. corporate control in Germany is more instrumentalized by interlocking directorships. The structural analysis of the partial networks leads to the conclusion that the capital network is characterised by a lower density and a lower degree of centralisation in comparison to the personal network. The capital network among firms in its current state can be described as relatively simple and as less dense which makes it relatively transparent.

Examining the underlying systematic logic of the governance structure in the network evidence for local regularities in the interlock between enterprises has been found for both networks, directorship and ownership. We suggest triadic structural

components to play an important role for large German enterprises. The general hypothesis that interdependencies between shareholdings and the exertion of personal control does exist, therefore, can be confirmed. Thus, individual inter-organizational relationships within the German governance system are not independent from each other. The decision whether a company enters into a power relation with another company by the delegation of a manager depends substantially on existent further relations of the same type between both enterprises. As expected, since network governance needs to be achieved across the entire network, directorship and ownership ties show both dyadic and extra-dyadic patterns of interdependence. With regard to directorship mandates a strong tendency for reciprocity can be assigned to the large German enterprises. Moreover, no evidence for the interdependence structure in the personal relations to exhibit a hierarchical character is found; thus the second hypothesis is rejected. For the ownership network our exploratory analysis of triad structure reveals a structural tendency towards intransitive 2-out-star triadic patterns and intransitive mutual triads. Thus, we suggest a strong mutual entwinement with preferred mutual control through cross-shareholdings within the Prime-All-Share network. The tendency for this particular structural pattern between firms may suggest a corporate strategy of "mutual hostages" *(Williamson, 1985)*. In other words, firms tend to aim for balances of power within the network by the means of cross-shareholdings. However, no clear tendency can be suggested with regard to transitivity within the cross-ownership structure, thus no clear statement can be made regarding any hierarchy in this partial network.

For the British governance system evidence has been found for intense board-to-board relationships as well as a great number of interlocking ownership between corporate actors. An extremely complex web of relations is established for the total network; however, the partial networks differ in a great way: whereas in the directorship network power is rather less concentrated given a broad integration of FTSE-350 members, the structure of the ownership network is characterised as typical ego-centric network with a very small number of core actors holding nearly ninety percent of all interlocking ownerships, mostly in the role as a sender with rather small stakes. For this reason, any comparison of other descriptive measures is rather difficult.

Examining the underlying systematic logic of the governance structure in the British network structural tendencies regarding triadic microstructure of British firms can suggested. At first, it can be noted, that evidence has been found for local regularities in both, the interlocking directorship network and the interlocking ownership network. Thus, we suggest triadic structural components to play an important role for large British enterprises. The general hypothesis that interdependencies between interlocking directorships on the one hand, and cross-shareholding on the other hand, does exist, therefore, can be confirmed. Board-to-board relations and ownership ties show both dyadic and extra-dyadic patterns of interdependence.

With regard to the directorship network structural tendencies of British enterprises are generally seen in multiple interlocks, in particular, for reciprocity, 2-out-star and 2-in-star configurations, but, a lower probability for actors is suggested to tend to indirect control sending a manager to another firm's board. With respect to the second hypothesis, we suggest a rather weak but still a structural characteristic of the British directorship network to be hierarchical rather than equivalent structured. Instead, network architecture is characterised by a rather equal distribution of power within the British directorship network.

In contrast, the web of cross-shareholdings can be evaluated: although the use of the model with network data surveyed for the British interlocking ownership network is rather limited in terms of interpretation of parameter estimates, we can suggest the central argument of the British network of shareholdings to be ego-centric. Evidence has been found for any such structural tendency towards reciprocity, a relatively strong tendency for the 2-out-star configuration, and again a rather weak preference for the 2-mixed-stars structural pattern. The second hypothesis can not be answered from the coefficients referring to the ownership network.

With regard to the SBF-250 sample evidence is found for a densely interlocked network with large preference for multiple directorships and a broad integration. Thus, we suggest a persistent demand of information and control of firms over others within the French governance system. However, no clear core members are identified who are dominant within the directorship network. In contrast, with respect to the French ownership network, a high degree of power concentration can be suggested, thus a rather asymmetric distribution of control identifying a core within the visualized

network structure. For the total interlock network evidence has been found for a great degree of overlap.

Examining the triadic microstructure for French enterprises within the respective partial networks the following findings can be summarised: evidence is found that besides dyadic also some tendency towards triadic behaviour of French enterprises is found. Thus the first hypothesis can be confirmed; i.e., individual interlocks within the French governance system are not independent from each other. For the directorship network the second hypothesis can be rejected, no statement can be made with regard to the ownership network.

In review, the major research question was to investigate whether particular network configurations (local sub-graphs) are important in determining structure among actors pertaining to the national sample. The implication of the work reported is that an adequate understanding of the power structures in countries varies as national variations in economic circumstances may have influenced the emergence of interlocks. Given that most research on this topic has focused on the structural characteristics of corporate networks from a descriptive way of studying the connective topography between interlocking corporate organisations, interestingly in this study a hypothesis-testing model is employed for a more comprehensive investigation of the complexity of the network structure beyond the dyadic level of analysis as well as its multi-causal logic. This allows obtaining a wider perspective on this issue picturing the systematic, i.e. the structural logic of corporate relationships and resultant impacts. In short, the purpose of field research was to obtain a depth of understanding of the systematic of corporate interlocks.

At first, two rather general statements can be made based on our empirical findings: first, corporate behaviour and strategy of the economy's largest enterprises regarding are different with regard to their structural tendencies in systematic logic. And second, more complex network configurations are less probable to occur over all networks.

During the descriptive analysis it has become apparent that the overall structures of the national inter-corporate networks are shaped quite differently. From the empirical results a different underlying systematic logic of the respective network can be followed. Thus, with respect to the microstructure we conclude on different corporate

behaviour in this regard; with regard to the macrostructure we conclude on players acting in different network environments.

With regard to the hypotheses set up we may summarize our findings: the general hypothesis can be confirmed for all network economies studied that within the respective governance networks interdependences between the interlocks do exist, which goes beyond the dyadic level. The prevailing personal and capital networks for the respective countries exhibit respectively both dyadic and extra-dyadic interdependencies over all countries. However, as expected, differences can be stated regarding the level of complexity within the respective partial networks of a network economy as well as between the various countries.

With respect to the second hypothesis different answers may be given with respect to the three network economies as well as the two types of interlock networks. In particular, for Germany's directorship network evidence is found to be of any hierarchical character whereas no clear statement can be made for the ownership network; same is found for the British governance network. For the French network of interlocking directorates hypothesis 2 has been rejected, no suggestion can be made for the network of ownership ties.

However, like in all empirical studies the measures have to undergo critical validation. Thus, evidence found and conclusions made must be treated carefully. With regard to the descriptive statistics on the network data the following has to be taken into account: in social network analysis, we are used to calculating descriptive statistics for networks, but not so used to accompanying these statistics with standard errors. Yet the general arguments for the benefits of standard errors do apply to social network analysis: it is useful to have an indication of how precise a given description is, particularly when like in our case making comparisons. The question in this case can be posed like this: is the level of interlock (i.e., the density of ties) different in two countries? Standard errors and statistical tests are inevitably based on considerations that the data – in our case, the network – "could have been different". These differences could occur because of observation errors, unreliability of measurement, the contingent – or probabilistic – nature of the processes that gave rise to the observed relations, sampling of vertices, choice of the observation moment, and many others. The problem

is that there are no established, widely applicable, ways of calculating standard errors for network statistics.

The current study produced also important methodological findings. The combination of tools that could be assigned to social network analysis with a quantitative probability model in order to estimate the prevalence of network configurations enables the Reader to get a more comprehensive picture of the corporate networks in the countries. The study makes methodological contribution in the particular model to examine network structural tendencies that are difficult to study using traditional social network analysis approaches hereby demonstrating the feasibility and utility of triadic analysis in inter-corporate networks. However, methodological developments are only fruitful to management scholars if coupled with theoretical hypothesis that will be tested regarding the investigation of structural tendencies within networks. Network scholars have suggested the network perspective could provide a more complete and comprehensive understanding of firm competitive behaviour, thereby linking network systematic and competitive behaviour. Little research has actually conceptualized network moves themselves as competitive actions. Some of the results from this exploratory study regarding the competitive implications of triadic structure can be used to research systematically network actions as competitive behaviour.

Finally, to underpin the importance of the research study, we comment that the empirical findings from this study gain importance given a changing corporate market as a result of an intensified competition within the ongoing process of globalisation leading to rising power of inter-organizational networks in globalizing markets in recent time. Thus, a comprehensive analysis of the systematic of the triad microstructure in the network economies included in this study is an essential contribution to research.

Moreover, the importance of the topic of current work is evident in the fact that local governance is currently transforming to global governance. Changing global preconditions may have contributed to a common alteration and adaptations of these inter-firm webs. Especially the changes in the international environment have triggered profound transformations in the preferences of national actors who have become increasingly trans-national and in the power relationships at the national level. In academic literature it is widely discussed whether regional governance gives way to

global governance or rather represents a handicap, whether regional integration in corporate networks hinder multilateral world trade and whether strategic corporate behaviour forming corporate networks raise global competition. From a macroeconomic perspective the question is whether networks assist or impede economic performance and if trans-national networks create economic interdependence among nation-states.

Particularly, the actuality of the theme is evident as there has been almost no previous local research on the topic which allows a comparative perspective. Thus, this study is an attempt to contribute to filling the gap in analytic interlock research. Moreover, the current research can be well used as a base for future studies in order to get a more comprehensive understanding of a realistic picture of inter-firm networks not only for the countries considered in this study, thus is a cornerstone to be read also by practitioners.

KOKKUVÕTE

Uusaegset majandust iseloomustavad tänapäeval kasvav dünaamilisus ning globaliseerumise, integratsiooni ja deregulatsiooni kõrge aste. Üha rohkem vastastikku seotud ja sõltuvas maailmas ning turgude, tootmise ja allikate globaliseerumise tingimustes hakkavad ettevõtted üksteisega sügavalt läbi põimuma. Võetakse järjest enam teatavaks, et organisatsioonid tegutsevad vastastikuse seotuse keskkonna suhetekontekstis ja et organisatsiooni püsimajäämine ja töövõime sõltuvad tihtipeale kriitilisel määral selle sidemetest teiste organisatsioonidega

Järelikult võib kõige selle taustal esitada järgmise küsimuse – kas võrgustikesse organiseerunud firmade ellujäämislootused on suuremad kui selliste firmade omad, kes hoiavad kinni vahetutest turusuhetest? Jaatavat vastust võiks toetada jätkuv, mitte üksnes "Euroopa võrgumajandustes" aset leidev globaliseerumisprotsess, mis kutsub esile intensiivistunud võistlusolukorra märksa globaalsemal konkurentsile allutatud turul. Kuna maailmamajandus muutub üha enam globaalselt integreerituks, võib eeldada, et hakkame seisma silmitsi just nimelt selliste küsimustega, kui püüame mõista firmadevaheliste suhete läbipõimunud süsteemi, mis loob nii ametlikke kui ka nähtamatuid võimuvõrgustikke.

Nende küsimuste käsitlemisel rakendatakse käesolevas uurimuses firmadevaheliste võrgustike uurimisel kasutatavaid vaatepunkte ja meetodeid. Üks sotsioloogia ja juhtimisteaduse ühiseid probleeme on (diaadiliste) suhtestruktuuride – st graafide – võrdlemine. Kui sellised struktuurid moodustuvad mingisuguse ühise elemendikomplekti alusel, kerkib üles loomulik küsimus, kas on olemas tendents, mille kohaselt need ühes struktuurikomplektis omavahel tugevasti seotud elemendid on teises struktuurikomplektis seotud üksteisega veelgi tugevamini – või hoopiski nõrgemini. Väidame siinkohal, et juhtimisvõrgustikud ei ole sündinud juhuslikult, vaid kujutavad endast pikema aja jooksul tekkinud institutsionaal-funktsionaalse komplementaarsuse arvukate ilmingute tagajärge. Ehkki on ilmunud palju uurimusi organisatsioonidevaheliste võrgustike struktuuri kirjeldustega, kus analüüsitakse üksteisega läbipõimunud äriorganisatsioonide sidemete topograafiat, on vähem tähelepanu pööratud triaadidele ja triaadilisele struktuurile, mis on üks organisatsioonidevaheliste võrgustike tähtsaid aspekte. Tegelikult eksisteerib kasvav vajadus mõista, kuidas moodustuvad sotsiaalsed struktuurid Euroopas, iseäranis Euroopa võrgumajandustes.

Käesoleva töö eesmärk on uurida Saksamaa, Prantsusmaa ja Ühendkuningriigi üldisel firmamaastikul prevaleerivate eelnevalt määratletud haldusvõrgustike struktuuri alusloogikat. Kõnealuseid riike välja valides võeti arvesse kaht kriteeriumi – esiteks turuorganisatsiooni sotsiaalse korralduse erinevusi ja teiseks firmadevaheliste suhete sügavalt läbipõimunud võrgustiku olemasolu.

Uurimuse sihiks on leida vastused alljärgnevatele uurimisküsimustele – kuidas on firmade (majanduslik) võim jaotunud suurte Euroopa riikide juhtimisvõrgustikes ehk teisisõnu, kuidas tegutsevad ning on organiseeritud ja juhitud firmad erinevaid ärijuhtimismudeleid omavates Euroopa võrgumajandustes; teiseks, milliseid struktuurialaseid tendentse võib täheldada vaadeldavate riikide äriühingute institutsionaalsete võimuvõrgustike triaadilistes mikrostruktuurides ja millist mõju need avaldavad; ning kolmandaks, kuidas oleks võimalik tõlgendada võrgustikes osalejate firmadevahelist käitumist diaadiliste ja triaadiliste moodustiste suhtes vastavate ärijuhtimissüsteemide põhikarakteristikute aspektist. Erinevate võrgukonfiguratsioonide analüütiline uurimine toob esile individuaalsete osalejate võrguintegratsiooni ulatuse ja suuna ning seetõttu muutuvad võimukonstellatsioonid väljavalitud riikide haldusvõrgustikes läbipaistvamaks.

Üldjuhul võib läbipõimumisi pidada võimalike võimusuhete tundemärkideks ning seega demonstreerib võrgustruktuuride kirjeldus ja haldussüsteemide alusloogika analüüs majandusliku võimu jaotumist riigi ettevõtlusmaastikul ja sotsiaalse kapitali jaotusstruktuuri – seda teise isiku ressursside enda huvides mobiliseerimist võimaldava potentsiaali aspektist. Järelikult on tähtis sotsiaalsete võrgustike arhitektuur, sest selle alusel kujuneb välja organisatsiooniline käitumine, ning muudatused võrgustiku struktuuris peaksid omama olulisi tagajärgi organisatsioonides omaks võetud strateegiate seisukohalt. Rahandus-, kaubandus- ja tööstusettevõtete vahelised võrgustikud määravad ära antud majanduse üldise korralduse ja sellest tuleneva majandusefektiivsuse olulised tunnusjooned.

Institutsionaalseid võrgustikke – st läbipõimunud juhtkondi ja omandussuhete seoseid – peetakse iseäranis sellistes võrgumajandustes nagu Saksamaa, Ühendkuningriigi ja Prantsusmaa majandus Euroopa ärijuhtimise üheks peamiseks elemendiks. Selle mehhanismi kaudu kehtestatakse teatav kontrollstruktuur ärijuhtimisvõrgustikus, mis on pikka aega olnud mitte just eriti läbipaistev. Viimasel ajal on siiski kõikide suurte tööstusriikide paljude eraorganisatsioonide või valitsuskomiteede koostatud õiget

ärijuhtimist puudutavad eeskirjad ja soovitused viinud kõnesoleva uurimisvaldkonna (peamiselt) akadeemilisele tasandile, luues võimaluse läbipõimunud võrgustike struktuuri laiahaardeliseks analüüsimiseks täies ulatuses ja süstemaatiliselt andmeid koguda.

Me määratleme oma andmestiku üldlevinud ja akadeemilistest konventsioonidest lähtudes kui konkreetse arvu suuri avalikke äriettevõtteid vaadeldavas konkreetses majanduses ühel kindlal uurimispäeval. Saksamaa puhul võtsime andmestikuna arvesse kõik need ettevõtted, mis olid kirjas kataloogis *Prime All Share-Index*, saades sellega valimi, mis hõlmab turukapitalisatsiooni alusel järjestatuna Saksa *Prime Standard*is loetletud suurimaid avalikke aktsiaseltse 2004. aasta lõpu seisuga. Ühendkuningriigi jaoks valiti andmestikku 2004. aasta lõpu seisuga Londoni aktsiabörsi indeksis FTSE-350 loetletud ettevõtted. See sektoriülene indeks ühendab endas FTSE-100, kuhu kuuluvad 100 kõige kapitaliseeritumat mainekat äriühingut, ja keskmise kapitaliseeritusega firmadest koosneva FTSE-250, esindades ühtekokku ligikaudu 95 % Ühendkuningriigi turukapitalisatsioonist. Prantsusmaal võtsime aluseks SBF250 indeksi 2004. aasta lõpu seisuga. See andmestik hõlmab suurimaid avalikke aktsiaseltse, mis on kirjas *Euronext Paris Premier Marché*, *Second Marché* ja *Nouveau Marché* jätku- või kinnistavates osades, ja omavad suurimat turukapitalisatsiooni üksikutes majandusharudes. Sellisel viisil saime oma uurimuse jaoks vastavate ettevõtteturgude kohta esindusliku valimi nendes kolmes võrgumajanduses eksisteerivate võimusuhete seisukohalt.

Üldjuhul ei ole uurimiseks sobiva võrgustiku piiritlemine ja asjaomaste ettevõtete valimi määratlemine sugugi mitte probleemivaba tegevus. Puuduvad selged kriteeriumid individuaalse juhtimissüsteemi piiritlemiseks ja seetõttu toetuvad meie valikukriteeriumid käesolevas uurimuses suurel määral tõenäosuslikele kaalutlustele.

Et tagada võrgustikku puudutavate andmete täpsus, kasutati üksnes esmaallikaid. Kuna puuduvad usaldusväärsed avalikud andmebaasid, mis annaksid hea ülevaate ettevõtete juhtide aktsiaomandist ja kapitalivaldamismandaatidest, hangiti andmeid aastaaruannetest ja väärtpaberiregistritest. Empiiriliste tulemuste usutavuse hindamisel võeti arvesse eelnevate võrgustiku-uuringute tähtsamaid arvandmeid.

Läbi viidud triaadianalüüsi üks põhieesmärke on jõuda mõistmisele, miks esinevad teatavad sidemete moodustumise mallid, ja iseäranis aru saada, milline on triaadiliste võrgukonfiguratsioonide esinemise tõenäosus ja milliste teguritega on nende esinemine seletatav. Triaadiline lähenemine organisatsioonidevaheliste võrgustike analüüsile on

viljakas uurimisvaldkond iseäranis turukonkurentsi triaadilist olemust arvestavast vaatepunktist. Triaadianalüüsil on võrgustike analüüsimisel pikk ja rikas ajalugu. Toogem näiteks *Davis*e *(1979)* ülevaade Davise, Hollandi ja Leinhardti uurimustest, *Laumann / Galaskiewicz / Marsden (1978)*, *Burt (1992)*, *Gambetta (1993)*, *Gargiulo (1993)*, *Baker / Obstfeld (1999)*, ja *Della Porta / Vannucci (1999)*. Graafiteoreetilisest seisukohast kaasneb sellise lähenemisega vaadeldavate võrgustike struktuuritendentside eristamine. Seda lähenemist näib olevat mõistlik kasutada võrgusüsteemide täieliku kirjelduse saamiseks, kui arvestada asjaolu, et võrgustikes osalejate isiklike ja kapitalisuhete sõlmimine ja säilitamine ei toimu üksteisest sõltumatult. Vaid üht suhtetüüpi käsitlevad uuringud saavad sisaldada üksnes piiratud pädevusega väiteid. Konkreetsemalt väidame, et vastastikused sõltuvused esinevad nii omandussidemete kui ka isikliku kontrolli teostamise vahel. Lühidalt, juhtimissüsteemi individuaalsed organisatsioonidevahelised suhted ei ole sugugi üksteisest sõltumatud. Tähendab, et otsuse langetamine selle kohta, kas firma astub võimusuhetesse teise firmaga mõne juhtiva töötaja delegeerimise või läbipõimunud omanduse abil, sõltub olulisel määral nende ettevõtete täiendavate omavaheliste suhete olemasolust.

Võttes arvesse asjaolu, et nii teoreetiline huvi juhtimise vastu firmadevaheliste võrgustike triaadides kui ka iseäranis meie rakendatud loglineaarne statistiline mudel on suhteliselt uudsed nähtused, püüdsime Euroopa võrgumajanduste suurtest ettevõtetest hangitud andmete najal demonstreerida nende mõlema tulusust ja potentsiaali.

Teoreetilisel tasandil väidame, et interaktsioonile kõnealustes võrgustikes on võimalik valgust heita sotsioloogilise võrguteooria strukturalistlikul loogikal põhineva lähenemise abil. Strukturalistlik loogika asetab rõhu sellele, kuidas konkreetsed suhete-mallid – käesoleval juhul läbipõimunud institutsionaalsed triaadid – kujundavad osalejate rolle ja strateegiaid. Triaadid loovad võimalusi liitude pidevaks ümber-kujundamiseks, sest suhetele kahe mis tahes võrgustikus osaleja vahel avaldavad mõju pöördumised kolmanda osaleja poole. Võib oletada, et ettevõtete siht on optimeerida oma vastavate suhetekomplektide (triaadilist) struktuuri võrgustikus. Sidemed osalejate paaride vahel on sotsiaalset võrgustikku genereerivate ja säilitavate sotsiaalsete protsesside interaktiivset iseloomu arvestades tavaliselt vastastikuses sõltuvuses. Tõendeid selliste vastastikuste mõjude kohta on võimalik leida tõsiasjast, et võrgustikes võib individuaalsete vahekordade ülesehituse tagajärjel tekkinud spetsiifilisi võrgu-

struktuure kindlaks teha sagedamini kui muid struktuure. Järelikult võib vastastikuseid mõjusid pidada võrguarhitektuuri jaoks tüüpiliseks.

Organisatsioonid loovad organisatsiooni (tippjuhtkonna) vaatepunktist nähtuna teadlikult suhteid mingisugustel konkreetsetel põhjustel ning nende valikuid piiravate või mõjutavate mitmesugustest tingimustest tulenevate piirangute raames. Üldjuhul loodavad ettevõtted nendest suhetest kasu saada ja iseäranis hankida endale erinevaid käitumisvõimalusi. Üks viise selle eesmärgi saavutamiseks võib olla interaktiivne koostegevus teiste organisatsioonidega. Ettevõtted püüdlevad struktuurse organiseerituse kontekstis kollektiivsete strateegiate poole koos teiste osalejatega. Võib koguni oletada, et osalejad liituvad võrgustikega teadlikult oma "interaktiivse ja institutsionaalse poliitika raames" *(Elsner, 2003)*.

Me arvame, et triaadilise mikrostruktuuri tendentsidest võib teha järeldusi nii ettevõtete firmadevahelise käitumise ja strateegia suhtes nende diaadilise ja triaadilise formeerituse ja sellest tulenevate konkurentsiomaduste aspektist kui ka sotsiaalse mõju ja selektsiooni kohta määratletud valimites, arvestades vastavate ärijuhtimissüsteemide eripärasid. Kõige olulisem juhtimisalane küsimus selliste uuringute puhul puudutab äriühingute käitumist ja strateegiat võrgustikuformatsioonides ning seda, kas võrgustikud aitavad majandustegevuse edukusele mingisugusest makro- või mikroökonoomilisest vaatepunktist kaasa või hoopiski takistavad seda.. Käesoleva uurimuse põhjal võib teha järeldusi äriühingute käitumise ja strateegia kohta ehk täpsemini osalejate firmadevahelise käitumise kohta diaadilise ja triaadilise formatsiooni suhtes ning sotsiaalse mõju ja selektsiooni ja triaadilisest struktuurist tulenevate konkurentsiomaduste kohta vastavates valimites, arvestades antud ärijuhtimissüsteemi eripärasid.

Testisime organisatsioonidevahelisi võrgustikke puudutavate andmete mittejuhuslikkust, kasutades hiljaaegu välja arendatud loglineaarset statistilist võrgumudelit p* *(Wasserman / Pattison, 1996)*, mis muudab hõlpsamaks põhjalikuma arusaamise ettevõtetevalimikus eksisteeriva läbipõimunud ärijuhtimissüsteemi struktuuri alusloogikast – triaadilisest mikrostruktuurist. Sellesse klassi kuuluvate tõenäosuslike mudelite eelised seisnevad asjaolus, et need modelleerivad globaalse võrgustiku struktuuri kui võrgustiku lokaalsetes sotsiaalsetes piirkondades toimuvate protsesside tagajärge. Sõltuvusmudelid käsitlevad üldjuhul üksikasjalikult punktide ja joonte seoseid. P* mudelite üldklassi kasutamisel võib tõenäosuslikke võrgumudeleid määratleda kui

loglineaarseid mudeleid logtõenäosusliku funktsiooniga mingisuguse väljavalitud võrgustatistika lineaarse kombinatsiooni kujul. Siinkohal läbi viidud konkreetse analüüsi eesmärk on mõista, kui suur on triaadiliste võrgukonfiguratsioonide täheldamise tõenäosus ja milliste teguritega võib nende esinemist selgitada, et selle abil paremini aru saada firmadevahelise triaadilise mikrostruktuuri olemusest.

P* mudelite klassi on vaadeldud kui Markovi eeldust sisaldavate diaadiliste interaktsioonimudelite edasiarendust. Kõigepealt käsitlesid seda *Frank / Strauss (1986)*, kes määratlesid seda kui Markovi juhusliku graafi distributsiooni. Edasisi arenguid ja iseäranis kommentaare distributsiooniparameetrite hindamise kohta toovad *Strauss / Ikeda (1990)*. Seejärel arendasid seda mudelite perekonda edasi *Wasserman / Pattison (1996)*, kes näitasid, kuidas Markovi parameetrieeldus pakub välja kõigest ühe paljudest võimalikest parameetrikomplektidest. See parameeter kajastab neid struktuuri-probleeme, mis eeldatavasti juhivad sotsiaalse ja/või käitumusliku alusprotsessi tõenäosuslikku olemust. Mitmemõõtmelisi p* mudeleid võib rakendada tõenäosus-põhistel lähenemistel mitmemõõtmelistele graafmodelleerimistele, kusjuures esimesena soovitasid neid kasutada ühemõõtmeliste võrkude puhul *Wasserman / Pattison (1996)*, edasiarenduse mitmemõõtmeliste võrkude jaoks aga esitavad *Pattison / Wasserman (1999)*. Markovi graafid lubavad sõltuvusi ükskõik milliste ühise sõlmpunktiga sidemete vahel. Järelikult võib sissekandeid uuringuandmeid koondavas sotsiomaat-riksis pidada p* mudeli kontekstis juhuslikeks hulkadeks. *Contractor / Wasserman / Faust (1999)* väitel hõlbustab p* selle uurimist, "kas vaadeldav graafirealisatsioon ilmutab teatavaid hüpoteesijärgseid struktuuritendentse […], hinnates neid parameetreid, mis kvantifitseerivad hüpoteesijärgsete struktuuriomaduste mõju sidemete olemasolu või puudumise tõenäosusele võrgus." Graafiteoreetilisest aspektist vaadelduna lubab p* analüüs uurijal hinnata seda, kas teoreetiliselt hüpoteesijärgsete omadustega konkreetsete graafirealisatsioonide täheldamistõenäosus on oluliselt suurem. Praktilises mõttes koosneb p* analüüs võrgust ennustavate tunnuste komplekti genereerimisest ja seejärel logistilise regressioonanalüüsi rakendamisest, et luua sari hierarhilisi mudeleid, mille puhul funktsioontunnuseks on sideme olemasolu või puudumine iga osalejate paari vahel.

P* mudel on mitmel põhjusel käesoleva uurimuse uurimiseesmärgi seisukohalt iseäranis sobiv. P* võtteid (*Wasserman / Pattison, 1996*) on võimalik kasutada selleks, et arendada välja laiahaardeline analüüsiraamistik ning selle abil konkretiseerida ja

ühtaegu ka testida teoreetilisi hüpoteese, mis aitavad paremini selgitada firmadevaheliste võrgustike teket 21. sajandi organisatsioonide maastikul. Võrreldes traditsioonilise lähenemisega triaadide empiirilisel uurimisel lubab p* uurida triaade ja triaadilist struktuuri süstemaatilisemalt ja rangemalt. Paljudele triaade puudutavatele olulistele küsimustele ei ole võimalik vastata, kui keskendutakse üksnes triaadidele, p* aga muudab võimalikuks selle jaoks vajaliku mitmetasandilise lähenemise rakendamise. Teiseks on nii, et küsimused, mis on seotud hajuvusega võrgustikus osalejate kalduvuses siduda ennast teatavat tüüpi triaadiliste tegevustega – näiteks ülemineku-valmidusega –, vajavad selliste p* sarnaste statistiliste mudelite kasutamist, mis võtavad arvesse asjaolu, et triaadid ei ole üksteisest sõltumatud. *Wasserman / Robins (2005)* näevad p* mudelite suurt väärtust selles, et need muudavad võimalikuks teadliku ja tulemusliku liikumise lokaalsetelt mikronähtustelt üldiste makronähtuste suunas.

Lihtsatele ja usutavatele argumentidele toetuvast teoreetilisest vaatepunktist on võimalik püstitada kaks hüpoteesi. Kuna võrgustikujuhtimine tuleb saavutada kogu võrgustiku ulatuses, on võimalik eeldada, et ärisidemete vastastikune sõltuvus omandab selliseid vorme, mis ei ole mitte lihtsalt diaadilised, vaid pigem ilmnevad omavahel läbipõimunud juhtkondade ja omandussuhete juures nii diaadilised kui ka diaadivälised vastastikuse sõltuvuse mallid (esimene hüpotees). Lisaks sellele on nii, et kuna institutsionaalne läbipõimumine leiab lõppkokkuvõttes aset mõju ja kontrolli saavutamise eesmärgil, võib ettevõtete mikrostruktuuri struktuuritendentside põhjal oletada hierarhilise iseloomu olemasolu, mida tuleb mõista kui osalejate strateegilist fikseeritust individuaalselt korrastatud firmadevaheliste suhete kaudu (teine hüpotees).

Et kontrollida ülalesitatud ootusi, tuleb kujundada selline mudel, mis lubab sõltuvusi võrgusidemete vahel. Ainuüksi niisuguse mudeli abil on võimalik tuvastada institutsionaalsetes läbipõimumistes korrapära konkreetseid vorme. Mudelite p* klass arendati välja just nimelt vastastikuste sõltuvuste analüüsimiseks ja siinkohal kasutatakse seda sõltuvuste uurimiseks läbipõimunud juhtimis- ja omandussidemete puhul.

Muude probleemide hulka, mida on võimalik tõstatada ennustavate muutujate kasutamisega eksponentsiaalsetes juhusliku graafi mudelites, kuuluvad mitmesugused sotsiaalse mõju ja sotsiaalse selekteerimise aspektid ettemääratud võrgustikus.

Alljärgnevalt tutvustatakse lühidalt empiirilisi leide iga konkreetse riigi uurimisel. Enne seda aga kirjeldatakse põgusalt vastava riigi tunnusjooni.

Hästi väljakujunenud ja ajalooliselt tekkinud läbipõimumiste süsteemile Saksamaa ärimaastikul avaldavad suurel määral mõju väliste kapitalifinantseerimise instrumentide tähtsus teiste riikidega võrreldes, aktsiakapitali suhteliselt suur kontsentratsioon nii pankade kui ka mittefinantsettevõtete puhul, pankade täiendav võim tänu ühtsele hääletamisele, avalike ülevõtmiste tõhusa reguleerimise puudumine ning arvukad viisid hääletamisõigustega manipuleerimiseks – näiteks mitme häälega aktsiate klasside olemasolu –, mis võivad takistada loovutamisõiguste üleandmist aktsiaturgudele. Kõik need tegurid üheskoos põhjustavad motiivide tekkimist finantsiliseks ja personaalseks läbipõimumiseks.

Saksa ärimaastiku puhul on võimalik leida tõendeid selle kohta, et on olemas pidev nõudmine informatsiooni ja teiste firmade kontrollimise järele. Koguvõrku iseloomustab laiaulatuslik ja tihe ärisuhete võrgustik, mis integreerib suurt arvu Saksa ettevõtteid. Nii näiteks on täheldatav keerukas ärisuhete põiming *Prime All Share Index*i firmade vahel. Saksamaa ärivõrgustiku olemuse määrab esmajoones kindlaks läbipõimuvate juhtkondade mall – st ärijuhtimisel kasutatakse Saksamaal rohkem ära läbipõimuvaid juhtkondi. Osavõrgustike struktuuri analüüs viib järeldusele, et kapitalivõrgustikku iseloomustavad isikuvõrgustikuga võrreldes väiksem tihedus ja madalam tsentraliseerituse aste. Firmadevahelist kapitalivõrgustikku võib selle praeguses seisundis nimetada suhteliselt lihtsaks ja mitte eriti tihedaks, mis muudab selle suhteliselt läbipaistvaks.

Võrgustiku juhtimisstruktuuri süsteemi alusloogika uurimisel avatati tõendeid selle kohta, et eksisteerivad mõlemad võrgustikud – nii juhtimisvõrgustik direktorite tasandil kui ka omandusvõrgustik. Me väidame, et Saksamaa suurettevõtetes etendavad tähtsat osa triaadilised struktuurikomponendid. Seega on võimalik leida kinnitust üldisele hüpoteesile, et eksisteerivad vastastikuse sõltuvuse suhted aktsiate valdamise ja isikliku kontrolli teostamise vahel. Järelikult ei ole organisatsioonidevahelised suhted Saksamaa juhtimissüsteemis üksteisest sõltumatud. Otsuse langetamine selle kohta, kas firma loob mõne juhi delegeerimise teel võimusuhted teise firmaga, sõltub olulisel määral muudest olemasolevatest sama tüüpi suhetest kahe ettevõtte vahel. Kuna võrgujuhtimine tuleb saavutada kogu võrgu ulatuses, demonstreerivad juhtimis- ja omandussidemed nii diaadilisi kui ka diaadiväliseid sõltuvusmalle. Juhtimismandaatide suhtes võib Saksamaa suurettevõtete puhul nentida jõulist tendentsi nende vastastikkusele. Lisaks sellele ei avastatud mitte mingisuguseid tõendeid isiklike suhete sellise

sõltuvusstruktuuri kohta, mis oleks toonud nähtavale nende hierarhilise struktuuri, ja seega on teine hüpotees tagasi lükatud. Omandusvõrgustiku puhul toob triaadilise struktuuri uurimisanalüüs nähtavale struktuurilise tendentsi intransitiivsete *2-out-star* triaadimallide ja intransitiivsete mutuaalsete triaadide suunas. Seega oleme arvamusel, et *Prime All Share* võrgustikus eksisteerib tugev põimumine, mis toimib eelistatavalt vastastikuse kontrolli kujul aktsiate ristomanduse kaudu. Tendents sellise konkreetse struktuurimalli suunas firmade vahel võib viidata "vastastikuse pantvangistamise" äristrateegiale *(Williamson, 1985)*. Ehk teisisõnu kalduvad firmad püüdlema võimutasakaalu poole võrgustikus aktsiate ristomanduse abil. Selles ristomanduse struktuuris ei ole siiski võimalik viidata mingisugusele selgesti väljendunud transitiivsustendentsile ning seetõttu ei saa ka esineda mingisuguse selge väitega hierarhia olemasolu kohta kõnealuses osavõrgustikus.

Briti ärijuhtimisstruktuuri iseloomustab suur arv ristkaasatusi direktorite nõukogude (juhtkondade) tasandil ehk seega intensiivsed suhted juhtkondade vahel. Briti ettevõtete omandistruktuurile on iseloomulik see, et tunduv osa suurettevõtetest ei kuulu mitte perekondadele või üksikisikutele, vaid teistele ettevõtetele. Aktsiakapital on suhteliselt hajutatud, kuid märkimisväärne osa koguaktsiakapitalist kuulub mitte pankadele, vaid muudele finantsasutustele. Seetõttu eeldame, et Briti juhtimissüsteemis eksisteerib firmade vahel laiaulatuslik aktsiate ristomanduse võrgustik. Aga kuna avalikud aktsiaturud on suured ja aktsiate valdamine üsnagi hajutatud, kuulub enamus aktsiaid sellistele investoritele, kes ei ole firmaga lähedalt seotud – st lõviosal börsinimekirja kuuluvatest Briti äriühingutest on küll olemas mingisugune domineeriv välisaktsionär või investeerimisgrupp, kuid ehkki selliste investorite valduses on kokkuvõttes märkimisväärne kogus erinevaid aktsiaid, on nende osalus üksikfirmades väike. Väga suur ja likviidne kapitaliturg etendab sõltumatu hindamisasutuse, ülevõtmisturu ja väga aktiivse ärialase kontrolliga turu rolli.

Briti ärijuhtimissüsteemi puhul avastati tõendeid intensiivsete juhtkondadevaheliste sidemete olemasolu kohta ning suurel arvul omandusõiguste läbipõimumisi. Kogu-võrgustikus tehti kindlaks äärmiselt keeruline suhetevõrgustik, osavõrgustikud aga erinevad teineteisest suurel määral – kui juhtimisvõrgustik on direktorite tasandil FTSE-350 liikmete laialdast integreeritust arvestades märksa vähem kontsentreeritud, siis omandusvõrgustiku struktuuri iseloomustab tüüpiline egotsentriline võrgustik väga väikese arvu tuumikosalejatega, kelle valduses on üsna väikeste üksikpanuste kujul

peaaegu üheksakümmend protsenti läbipõimunud omandist. Seetõttu on igasugune muude deskriptiivsete mõõdikute võrdlemine üpris raske.

Briti võrgustiku juhtimisstruktuuri süsteemi alusloogika uurimisel saab teha oletusi Briti firmade triaadilise mikrostruktuuri strukturaalsete tendentside kohta. Esiteks võib nentida, et on leitud tõendeid lokaalsete regulaarsuste kohta mõlemas, nii läbipõimunud juhtimisvõrgustikus kui ka läbipõimunud omandusvõrgustikus. Seetõttu arvame, et Briti suurettevõtete jaoks etendavad tähtsat rolli triaadilised struktuurikomponendid. Järelikult on võimalik kinnitada üldist hüpoteesi läbipõimunud direktorikohtade ja aktsiate ristomanduse vaheliste vastastikuste sõltuvuste olemasolu kohta. Juhtkondadevahelistes suhetes ja omandussidemetes võib täheldada nii diaadilisi kui ka diaadiväliseid sõltuvusmalle.

Direktorite tasandil juhtimisvõrgustike struktuuritendentside aspektist võib Briti ettevõtete puhul üldjuhul näha mitmekordseid läbipõimumisi retsiprooksuse ning *2-out-star* ja *2-in-star* konfiguratsioonide juures, kuid on alust arvata, et osalejate kalduvus teostada kaudset kontrolli mõne liikme saatmisega teise firma juhtkonda on väiksema tõenäosusega. Teise hüpoteesi suhtes arvame, et üks Briti juhtimisvõrgustiku küll üsna nõrk, kuid siiski eksisteeriv struktuuriline tunnusjoon on selle mitte ekvivalentne, vaid pigem hierarhiline struktureeritus. Võrguarhitektuuri aga iseloomustab võimu üsna ühtlane jaotumine Briti juhtimisvõrgustikus.

Aktsiate ristomanduse võrgustikku on see-eest võimalik hinnata – ehkki antud mudeli kasutamine Briti läbipõimunud omandusvõrgustikust kogutud võrgustiku-andmete puhul on parameetrihinnangute interpreteerimise aspektist üsnagi piiratud, võime siiski väita, et Briti aktsiaomamisvõrgustiku keskne argument on egotsentrilisus. On leitud tõendeid strukturaalsete tendentside kohta retsiprooksuse suunas, suhteliselt tugev tendents *2-out-star* konfiguratsiooni suunas ja taas üpriski nõrk *2-mixed-stars* struktuurimalli eelistamine. Omandusvõrgustikku puudutavate koefitsientide põhjal ei ole võimalik teisele hüpoteesile vastust anda.

Prantsuse ärijuhtimise süsteemi võib lugeda insaiderile orienteeritud süsteemiks, millel on tugevad sidemed avaliku sektoriga – st eksisteerivad traditsiooniliselt lähedased sidemed riigiasutuste ja eraettevõtete vahel. On olemas tunduv eelistus mitme direktorikoha omamise suunas; esile võib tõsta teatavat piiratud vahekorda riigiga. Suurfirmad riigiga sidunud eliidipõhine koordinatsioonimehhanism loob tingimused juhtimise autonoomsuseks nii riigist kui ka aktsiaturust. Prantsusmaa äriettevõtete

omandistruktuuri puhul võib nentida kolme silmatorkavat tunnusjoont – need on omandi kontsentratsioon, laialt levinud perekonnaomand ja *holding*-kompaniide osatähtsus. Prantsuse ettevõtted on tihtipeale seotud üksteisega keeruliste ristomanduste kaudu ja selline olukord kaitseb firmasid vaenulike ülevõtmiste eest. Prantsusmaa kapitali- ja pangandusstruktuur on juba ajalooliselt nõrk ning seetõttu on kuni suhteliselt hiljutise ajani kestnud tugev toetumine omafinantseerimisele, millest tuleneb omandi koondumine üksikisikute ja perekondade kätte. Prantsusmaal leidub arvukalt suuri tööstusrühmitusi kontrollivaid *holding*-kompaniistruktuure, mis tähendab seda, et suured tööstusrühmitused on seotud üksteisega finantsholdingkompaniide kaudu. Üldkokkuvõttes võib Prantsusmaal oodata firmadevahelises võrgustikus keerukat ärisuhete võrgustikku.

SBF-250 valimi puhul on avastatud tõendeid tihedasti läbipõimunud võrgustiku kohta koos tugevate eelistustega mitmete direktorikohtade valdamise ja laialdase integratsiooni suunas. Seega võib arvata, et Prantsuse juhtimissüsteemis on olemas püsiv nõudmine informatsiooni ja teiste firmade kontrollimise järele. Ei ole siiski tuvastatud tuumikliikmeid, kes domineeriksid direktorivõrgus teiste üle. Aga Prantsuse omandusvõrgustikus võib sootuks vastupidiselt viidata kõrgel astmel võimukontsentratsioonile ning seega on tegemist kontrolli üsna asümmeetrilise jaotumisega, mis tuvastab visualiseeritud võrgustruktuuris teatud tuumiku. Kogu põimumisvõrgustiku puhul on leitud tõendeid suure kattuvuse kohta.

Prantsuse ettevõtete triaadilise mikrostruktuuri kohta võib osavõrkude uurimise tulemusena kokkuvõtlikult esile tuua alljärgnevat: on leitud tõendeid selle kohta, et lisaks diaadilisele käitumisele esineb Prantsusmaa ettevõtetes ka teatav tendents triaadilise käitumise suunas. Järelikult võib kinnitada esimest hüpoteesi – st individuaalsed läbipõimumised Prantsuse juhtimissüsteemis ei ole üksteisest sõltumatud. Direktoritevõrgustiku suhtes võib teise hüpoteesi kõrvale heita, omandusvõrgustiku kohta aga ei ole võimalik mingisuguseid väiteid esitada.

Üldkokkuvõttes oli peamine uurimuses püstitatud küsimus teha kindlaks, kas konkreetsed võrgukonfiguratsioonid (lokaalsed alamgraafid) omavad tähtsust antud riigi valimisse kuuluvate osalejate struktuuri määramisel. Uurimusest järeldub, et adekvaatne ettekujutus riigi võimustruktuurist on riigiti erinev, sest läbipõimumiste tekkimisele võivad olla mõju avaldanud rahvuslikud variatsioonid majandustegevuse asjaoludes. Võttes arvesse, et suurem osa uurimistöid kõnealusel teemal on keskendunud ärivõrgus-

tike struktuurikarakteristikutele ja vaatlevad kirjeldavalt läbipõimunud äriorganisatsioonide ühenduste topograafiat, on käesolevas uurimuses huvipakkuvalt rakendatud hüpoteeside testimise mudelit, et laiahaardelisemalt uurida võrgustruktuuri keerukust diaadilisest analüüsist kõrgemal tasandil ning samuti selle multikausaalset loogikat. See annab võimaluse vaadata antud probleemi avaramast vaatevinklist, luues pildi süsteemist – st äridevaheliste suhete struktuuriloogikast ja kaasmõjudest. Lühidalt öeldes oli väliuuringu eesmärk omandada parem arusaamine äride vastastikuse läbipõimumise süstemaatikast.

Kõigepealt võib meie empiiriliste leidude põhjal esineda kahe üsna üldise väitega. Esiteks on majanduse kõige suuremate ettevõtete ärikäitumine ja äristrateegia erinevad nende süsteemiloogika struktuuritendentside seisukohalt. Ja teiseks on keerukamate võrgukonfiguratsioonide esinemine kõikides võrgustikes väiksema tõenäosusega.

Deskriptiivse analüüsi käigus on selgunud, et üksikute riikide äridevahelised võrgustikud on üsna erineva vormiga. Empiiriliste tulemuste põhjal võib kindlaks teha vastavate võrgustike süsteemide erinevad alusloogikad. Seega me teeme mikro-struktuuri puhul järeldusi äride erineva käitumise suhtes, makrostruktuuri puhul aga järeldusi erinevates võrgustikukeskkondades tegutsevate mängijate kohta.

Püstitatud hüpoteeside suhtes võime teha nende leidude alusel järgmise kokkuvõtte. Kõikide uuritud võrgumajanduste puhul on võimalik kinnitada üldist hüpoteesi, et vastavates juhtimisvõrgustikes eksisteerivad läbipõimumiste vahel diaadilisest tasandist kaugemale ulatuvad vastastikused sõltuvused. Üksikutes riikides valdavates isiku- ja kapitalivõrgustikes ilmnevad kõikides riikides nii diaadilised kui diaadivälised sõltuvused. Aga nagu võiski oodata, on võimalik sedastada erinevusi keerukuse astmes nii ühe võrgumajanduse üksikute läbipõimunud osavõrgustike vahel kui ka erinevate riikide vahel.

Teise hüpoteesi suhtes on vastused nii kõnesoleva kolme võrgumajanduse kui ka läbipõimunud võrgustike kahe tüübi puhul erinevad. Konkreetsemalt on Saksamaa direktoritevõrgustikus leitud tõendeid selle hierarhilise iseloomu kohta, kuid omandus-võrgustiku kohta ei saa esineda mingisuguse selge väitega. Samasugused leiud on tehtud ka Briti juhtimisvõrgustikus. Prantsusmaa läbipõimunud juhtkonnavõrgustike puhul on teine hüpotees tagasi lükatud, omandussidemete võrgustiku kohta pole aga võimalik midagi kindlat väita.

Aga nagu kõikide empiiriliste uuringute puhul, nii tuleb ka siin mõõdikud kriitilise pilguga üle vaadata. Järelikult on vaja leitud tõendusmaterjali ja tehtud järeldustega ettevaatlikult ümber käia. Võrgustikuandmete deskriptiivse statistika seisukohast tuleb võtta arvesse alljärgnevat – me oleme küll harjunud sotsiaalsete võrgustike analüüsimisel arvestama välja deskriptiivset statistikat, kuid sugugi mitte nii väga harjunud kaasama selle statistikaga standardvigu. Ometi on üldised argumendid standardvigade rakendamise tulususe kohta kehtivad ka sotsiaalsete võrgustike analüüsimisel, sest on ju kasulik omada mingisugust ettekujutust sellest, kui täpne antud kirjeldus on, ja iseäranis sellise juhtumite puhul nagu praegune, mil tegeldakse võrdlemisega. Käesoleval juhul võib küsimuse püstitada alljärgnevalt – kas läbipõimumise aste (st sidemete tihedus) on kahes riigis erinev? Standardvead ja statistilised testid põhinevad vältimatult kaalutlusel, et andmed – meie juhtumil võrgustik – "võisid olla teistsugused". Need erinevused võisid tuleneda vaatlusvigadest, mõõtmiste ebausaldusväärsusest, vaadeldud vahekordi põhjustanud protsesside juhuslikust või tõenäosuslikust iseloomust, ainuüksi tippesindajate võtmisest valimisse, vaatlushetke valimisest ja paljudest teistest põhjustest. Probleem seisneb selles, et puuduvad kindlakskujunenud ja laialdaselt rakendatavad viisid standardvigade väljaarvestamiseks võrgustatistika jaoks.

Käesolev töö andis tähtsaid tulemusi ka metodoloogilisest seisukohast. Sotsiaalsete võrgustike analüüsimisel rakendatavate vahendite ühendamine võrgukonfiguratsioonide leviku hindamisel kvantitatiivse tõenäosusmudeliga annab lugejale võimaluse saada laiahaardelisem pilt nende riikide ärivõrgustikest. Uurimus annab oma panuse metodoloogiasse ühe konkreetse mudeli näol selliste võrgustiku struktuuritendentside uurimiseks, mille uurimine sotsiaalsete võrgustike uurimisel kasutatavate traditsiooniliste lähenemistega on raske, demonstreerides seega triaadianalüüsi rakendatavust ja tulusust äridevaheliste võrgustike analüüsimisel. Metodoloogilised arengud on juhtimisteadlaste seisukohalt viljakad siiski üksnes juhul, kui nendega käib kaasas teoreetiline hüpotees, mida testitakse võrgustike struktuuritendentside uurimisel. Võrgustikega tegelevad teadlased on avaldanud arvamust, et võrgustikuperspektiiv suudab anda täielikuma ja laiahaardelisema arusaamise firmade konkurentsikäitumisest, sidudes teineteisega võrgusüstemaatika ja konkurentsikäitumise. Tegelikult on üksnes vähestes uurimistöödes kontseptualiseeritud võrgustikutegevusi konkurentsitoimingutena. Mõnda käesoleva katselise uurimuse tulemust triaadilise struktuuri konkurentsi-

võitlust puudutavate mõjude kohta on võimalik kasutada selleks, et uurida süstemaatiliselt võrgutoiminguid kui konkurentsikäitumist.

Nagu kõikidel akadeemilistel uurimustel, nii on ka käesoleval tööl oma piirangud ja nõrgad kohad. Sellegipoolest peaksid uurimuse tulemused andma vähemalt esialgse vastuse küsimusele uuritud juhtimisvõrgustike struktuuri süsteemi alusloogika kohta.

Esimene piirang tuleneb andmevalikuprotsessi suhtes tehtud eeldustest ja määratlustest – omavahel seotud agentide komplektist koosnevate võrgustike piirid määrab ära teatav konkreetne valim firmadest (mainel põhinev lähenemine). Muidugi ei pruugi võrgustikul olla tõelisi "piire", kuid empiirilise uuringu teostamisega kaasnevad praktilised asjaolud nõuavad tihtipeale, et mingi otsus tuleks nende suhtes vähemalt implitsiitselt langetada. Järelikult on sisuliselt tegemist täisvõrgustiku ebatäiusliku representatsiooniga, sest ühendusi väljaspool seda tegevuskohta ei võeta arvesse. Sellegipoolest annab andmestik, mis koosneb turu kapitaliseerumise seisukohalt suurimatest antud konkreetse riigi börsinimekirjades figureerivatest äriühingutest, ärimaastikust peaaegu täieliku pildi.

Teiseks ei kajasta kahe institutsionaalse läbipõimumise kohta kogutud andmestiku selektsioon ja kehtestatud ahtad määratlused täiel määral vastavates juhtimisvõrgustikes valitsevate suhete põimingut. Üksikute riikide uurimisel kasutatud määratlused on siiski kehtestatud juhtimise vaatepunkti silmas pidades, et hankida kasulikke võrgustikuandmeid nende edaspidiseks tõlgendamiseks.

Kolmandaks seab logitmudelite kasutamine arvukalt piiranguid parameetrite hindamise protseduuri suhtes. Peale selle on hiljutised uuringud näidanud, et lisaks diaadilistele ja triaadilistele võrgustikukonfiguratsioonidele annavad väärtuslikku informatsiooni ka mitmesed võrgustikukonfiguratsioonid.

Kirjanduses pööratakse peamist statistilist tähelepanu üksiksuhete (ehk ühemõõtmeliste suhete), dihhotoomsete suhete ja suunatud suhete tõenäosuslikele võrgustikumudelitele. Esiteks toob see võrgustikukonfiguratsioone puudutavates väidetes endaga kaasa informatsioonikao väärtustatud võrgustikuandmete suhtes. Teiseks on ju võimalik hinnata ka sõltuvusi erinevate suhtetüüpide vahel ja seega võiks kahemõõtmeline või mitmemõõtmeline analüüs anda suhtestruktuuri loogika uurimisel kasulikku informatsiooni.

Lisaks tuleb esineda üldise väitega, et kuna iseäranis viimastel aastatel on ilmunud arvukalt publikatsioone kõnealuse teema ja valdkonna kohta, on täiesti võimatu kaasata

oma arutlustesse kõiki esitatud mõtteid, rääkimata juba sellest, et meile seab piiranguid uurimuse maht. Autorite eesmärk ei olegi kommenteerida kõiki tõstatatud küsimusi, vaid pigem pööratakse käesolevas uurimuses tähelepanu ühele konkreetsele juhtimis-süstemaatikaga seotud probleemile Euroopa läbipõimunud ärivõrgustikes.

Et rõhutada uurimistöö tähtsust, nendime lõpuks, et käesoleva töö empiirilised tulemused omandavad tähtsuse ärituru selle muutumise valguses, mille põhjuseks on intensiivistuv konkurents toimuva globaliseerumisprotsessi raames, mis viib peagi välja organisatsioonidevaheliste võrgustike võimu kasvamisele globaliseeruvatel turgudel. Järelikult kujutab võrgumajanduste triaadilise mikrostruktuuri süstemaatika laiahaardeline analüüs käesolevas uurimuses endast olulist panust uurimistöösse.

Käesolevas töös käsitletud teema tähtsus nähtub juba tõsiasjast, et lokaalne juhtimine on praegusel hetkel muutumas globaalseks juhtimiseks. Firmadevaheliste võrgustike üldisele teisenemisele ja kohanemisele võib olla kaasa aidanud ka globaalsete eeltingimuste muutumine. Iseäranis rahvusvahelise keskkonna muutused on käivitanud sügavad teisenemised üksikute riikide järjest ülerahvuselisemaks muutuvate osalejate eelistustes ning võimusuhetes riigi tasandil. Akadeemilises kirjanduses peetakse laialdaselt aru selle üle, kas regionaalne juhtimine asendub globaalse juhtimisega või kujutab endast lihtalt teatavat puuet, kas regionaalne integratsioon ärivõrgustikes on multilateraalsele maailmakaubandusele takistuseks ja kas äriettevõtete ärivõrgustikke moodustav strateegiline käitumine õhutab globaalset konkurentsi. Makromajanduslikust vaatepunktist nähtuna seisneb küsimus selles, kas võrgustikud aitavad majandus-tegevuse efektiivsusele kaasa või pärsivad seda ja kas rahvusülesed võrgustikud loovad vastastikuse majandusliku sõltuvuse rahvusriikide vahel.

Kõnealuse teema aktuaalsus on silmnähtav ka sellepärast, et antud valdkonnas pole varem peaaegu üldse teostatud lokaalseid uuringuid, mis muudaksid võimalikuks võrdleva perspektiivi kasutamise. Järelikult kujutab käesolev uurimus endast katset aidata kaasa selle lünga täitmisele läbipõimumiste analüütilisel uurimisel. Lisaks on uurimust võimalik hästi ära kasutada lähtepunktina tulevasteks uuringuteks, et jõuda laiahaardelisema arusaamiseni firmadevaheliste võrgustike tõepärasest pildist mitte üksnes käesolevas uurimuses käsitletud riikides, ja seetõttu on see töö üks neid põhimaterjale, mida peaksid lugema ka praktikud.

ANNEX A: GERMANY

ANNEX B: UNITED KINGDOM

ANNEX C: FRANCE

REFERENCES[485]

[485] In alphabetical order.