WHEN DOES STRATEGIC GROUP MEMBERSHIP IMPACT FIRM PERFORMANCE?

THE ROLE OF MULTIMARKET COMPETITION AND STRATEGIC NETWORKS

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ABSTRACT

When Does Strategic Group Membership Impact Firm Performance?

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Does strategic group membership affect firm performance? Strategic management scholars have long shown keen interest in elucidating this question. Yet, after three decades of theoretical and empirical investigation, little agreement has been reached over the research findings. Extant research examining the relationship between strategic group membership and firm-level performance has produced mixed and sometimes contradictory findings. Results vary from strong support for such a relationship, to only a small or non-significant association, along with some studies suggesting that the strength of the relationship is sensitive to research methodology.

Drawing from multi-point competition, structural embeddedness and social network literature, this longitudinal study attempts to address the inconsistency of these findings by proposing that the level of within-group multimarket contact, the density of ties maintained among group members, the extent of their role equivalence, and their centrality in the industry's network of strategic alliances moderate the relationship between strategic group membership and firm performance. Four hypotheses based on these arguments were tested using three samples from the pharmaceutical, the airline and the automotive industries. Empirical results provide support for all four hypotheses and suggest that analyzing the performance effects of strategic group membership independently of group members' market and network positions strongly eclipses the complex dynamics underlying persistent performance differences in an industry.

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1. INTRODUCTION

Strategic management scholars have long shown keen interest in uncovering the sources of persistent performance differences across industries and firms. As profitability differences across firms may not persist over time under conditions of perfect competition, researchers have directed most of their attention towards the investigation of the role played by market imperfections and interfirm heterogeneity in generating the observed performance variations among firms (Gonzalez-Fidalgo & Victoria, 2002, Mauri & Michaels, 1998). In essence, three distinct perspectives focusing on market imperfections and inter-firm heterogeneity, each adopting a different level of analysis, continue to have a significant influence in strategic management literature. At the one extreme, the industrial organization economics suggest that the observed performance variations across industries and firms might be explained by the presence of market imperfections resulting from particular industry market structures (Bain, 1951; Scherer & Ross, 1990). This perspective considers the industry as the basic unit of analysis, and hence, assumes that all firms within an industry are homogeneous. At the other extreme, the resource-based view stresses inter-firm heterogeneity in resources and competencies as the main driving force underlying the observed dispersion of performance between firms (Barney, 1991; Peteraf, 1993). This second perspective takes the firm as the basic unit of analysis. Between these two extremes, there exists a third perspective which adopts an intermediate level of analysis: the strategic group. This stream of research emphasizes the asymmetry of mobility barriers protecting groups of firms in an industry as the principal explanation for the persistent performance differences among firms (Caves & Porter, 1977; Dranove et al., 1998).

The rationale underlying the strategic group-performance relationship is that the asymmetrical mobility barriers, which define strategic groups, may allow some groups to systematically outperform others. Mobility barriers are group-specific entry barriers that allow members of a focal strategic group to earn above normal returns, while at the same protecting the group from outside entry. Strategic group theory suggests that members of groups protected by high mobility barriers may realize above-average profitability because they cannot easily be imitated by firms outside the group without substantial costs, long period of time, or high uncertainty about the outcome (McGee & Thomas, 1986). On the other hand, when mobility barriers surrounding the group are low, group members may not be able to earn above average returns because group outsiders can easily emulate the strategies and resources of group members, thus increasing competitive rivalry.

Yet, three decades after the introduction of the strategic group concept, there is still considerable disagreement about precisely when strategic group membership affects firm performance. Prior research investigating the relationship between strategic group membership and firm-level profitability has produced mixed and sometimes contradictory findings. Results range from strong evidence for such a relationship (e.g., Mascarenhas & Aaker; 1989; Nair & Kotha, 2001; Oster, 1982) to only a small or non-significant association (e.g., Cool & Schendel, 1987; Frazer & Howell 1983; Porter, 1979), along with some studies finding that the strength of the relationship is sensitive to research methodology (Ketchen, et al. 1997). These findings suggest that the relationship between strategic group membership and performance exists, but only in specific settings or under certain conditions. Accordingly, recent strategic group research has moved away from attempts to unveil a universal relationship linking strategic group membership and firm performance which holds in all industry settings to attempts to uncover those conditions under which the performance implications of firm strategic group membership are more significant.

This longitudinal cross-industry study contributes to strategic group research by examining the impact of one of these conditions, namely the extent of within-group rivalry, on the performance implications of firm strategic group membership. Building upon Dranove et al., (1998), I argue that the presence of effective mobility barriers is a necessary, though not sufficient, condition for group members to achieve above-normal profits. The ability of a strategic group to consistently outperform other groups *also* depends upon group members' *conduct*, which is reflected in their capability to coordinate their actions and to limit price wars and other destructive competition inside the group. More specifically, the main argument put forth in this study is that the members of the group protected by the highest mobility barriers must overcome *endogenous barriers* to coordination in order to persistently outperform other groups ranking lower on the mobility barriers hierarchy. If rivalry among members of the group presumably sheltered by the highest mobility barriers is intense, one would expect that group members' ability to successfully raise output prices will be significantly reduced

(Barney & Hoskisson, 1990). Therefore no performance differences across groups will be detected, despite the presence of asymmetrical mobility barriers in the industry (Barney & Hoskisson, 1990).

While the argument that the extent of inter-firm rivalry *within* strategic groups moderates the relationship between group membership and firm performance is a beginning, it begs the question of what are the factors that may lessen rivalry among strategic group members? The answer to this question is fundamental because it will specify some of the conditions under which strategic groups *will* and *will not* have implications on firm performance. Drawing from multi-point competition, structural embeddedness and social network literature, I develop the rationale for considering the role of several important factors which, through their effect on within-group rivalry, moderate the relationship between strategic group membership and performance. Specifically, I argue that extensive multimarket contact among firms belonging to the same strategic group, when reinforced by effective mobility barriers, may offer group members a market-based self-discipline mechanism which, by promoting coordination and lessening rivalry inside the group, increases the performance implication of group membership. Similarly, I suggest that the density of ties maintained among group members, the extent of their role equivalence, and their centrality in the industry's network of strategic alliances may endow group members with a network-based self-discipline mechanism which, if supported by effective mobility barriers, enhances the performance implication of group membership.

I tested the theoretical framework briefly introduced above using longitudinal data from three different industries. The moderating impact of multimarket competition on the performance effects of strategic group membership was tested using two samples from the pharmaceutical and the automotive industries, while the moderating effect of strategic alliance networks was tested using two samples from the pharmaceutical and the airline industries[1]. Various theoretical and empirical grounds make these industries an ideal research setting for this study. First, a wide consensus regarding the presence of strategic groups protected by asymmetrical mobility barriers in each of the three industries is found in prior research (Bogner, Thomas & McGee, 1996; Cool & Schendel, 1987, 1988; Cool & Dierickx, 1993; Garcia-Pont & Nohria, 2002; Guedri & McGuire, 2002; Kling & Smith, 1995; Nohria & Garcia-Pont, 1991; Peteraf, 1993). Second, both the pharmaceutical and the automotive industries have a remarkably clear geographic product - market definition, which facilitates the investigation of the effect that multipoint competition has on strategic group performance (Baum & Korn, 1996; Bhaskar, 1980; Bogner, Thomas & McGee, 1996; Gimeno & Woo, 1996; Rhys, 1972). Third, extent research indicates that highly developed networks of strategic alliances exist in both the pharmaceutical and the airline industries, which allows for testing the impact of the density of ties, of role equivalence and of centrality on strategic group performance (Baum, Calabrese & Silverman, 2000; O'Connor, 2001; Powell, Koput & Smith-Doerr, 1996). Finally, the three industries feature very distinct characteristics, which improves the external validity of this research's findings.

[1] I was not able to test the moderating effect of (1) multimarket competition in the airline industry context and (2) alliance networks in the automotive industry because reliable data was not available.

This research is organized as follows. The second section briefly reviews the rationale underlying the relationship between strategic group membership and performance. The major theoretical and empirical gaps in past research identified in the second section are more thoroughly discussed in section three. Next, the paper develops a theoretical framework, drawing upon multimarket competition theory, to present a research hypothesis reflecting the moderating role played by multimarket contact among strategic group members on the relationship between strategic group membership and performance. The fifth section builds upon structural embeddedness and social network literature to suggest several research hypotheses illustrating how the positioning of strategic group members within strategic networks moderates the performance implications of strategic group membership. The sixth section describes the research methods employed, including research settings, sample, time frame and measures. Next, the seventh section presents the empirical results. Finally, research implications of the theoretical framework developed in this study are discussed in the conclusion.

2. STRATEGIC GROUP MEMBERSHIP AS A DETERMINANT OF FIRM PERFORMANCE

Until the end of 1970s, the theory of industrial organization has been the dominant framework for analyzing the nature of competition and the distribution of firms' profitability in an industry (Bain, 1951; Bogner et al., 1998; Conner, 1991; Mason, 1957; Porter, 1981, 1977; Scherer & Ross, 1990). Industrial organization theory has been developed at the industry level of analysis, and hence, it has presumed that all firms in an industry are identical in all economically important dimensions, except for differences in size (Porter, 1979; Scherer & Ross, 1990). At the heart of this assumption is the view that structural characteristics of the industry, which ultimately shape the conduct (e.g. strategy) of firms, affect *equally all* industry participants. Accordingly, all established firms are expected to have the same strategy, which remains unchanged as long as the characteristics of industry structure are not altered by exogenous forces (Porter, 1976). Following this line of reasoning, most industrial organization empirical studies have bypassed firm conduct and have examined the direct link between industry structure and firm performance (Conner, 1991, Porter, 1976; 1981; Scherer & Ross, 1990). Particular attention has been given to investigating the hypothesized positive relationship between industry concentration and firm performance. The empirical findings have been, however, less than conclusive, suggesting at best a weakly positive relationship (Conner, 1991; Demsetz, 1973; Marcus, 1969; Scherer & Ross, 1990).

As a result of the weak empirical support for the structure-performance relationship, many of the premises of the industrial organization framework have come under widespread criticism on both theoretical and empirical grounds. In particular, critics have suggested that the framework largely ignores, despite their importance, several economically relevant intra-industry differences in firm strategies, characteristics, and market power (Porter, 1976). For example, Hunt (1972) challenged the assumption of intra-industry firm homogeneity by recognising the existence of groups of firms-*strategic groups*, which were adopting *distinct* strategies in the home appliance industry.

Hunt (1972) isolated four strategic groups of competitors in the industry based on three strategic variables: (1) extent of vertical integration, (2) degree of product differentiation and (3) differences in product differentiation. Moreover, he found that even though the industry was highly concentrated, the profitability of the industry was low, a finding that is inconsistent with the structure-conduct-performance hypothesis. Hunt concluded that the presence of different groups of firms adopting asymmetrical strategies lessen the faculty of oligopolists to attain coordination, which explains the decline of the average profit of the industry as a whole. The fundamental implication of Hunt's finding is that if industry structure is to be conceptualized as a set of distinct strategic groups, then overall industry concentration measures are poor predictors of firm performance. Using similar approaches, several other studies extended Hunt's research by focusing on the benefits of redefining the concept of industry structure in terms of strategic groups configuration. Such studies identified distinct strategic groups based on vertical integration (Newman, 1973; 1978), firm size (Caves & Pugel, 1980; Porter, 1979), stock price elasticity (Ryans & Wittink, 1985), leverage (Baird & Sudharsan, 1983), price, advertising and promotion (Hatten & Hatten, 1985; Tassey, 1983; Hawes & Crittenden, 1984). Hence, by relaxing the assumption of intra-industry homogeneity, this stream of research viewed the industry as a collection of strategic groups, where each group is composed of firms adopting similar strategies in terms of the economically important decision variables.

Industry configuration in terms of strategic groups may influence the expected distribution of firms' profitability within the industry (Caves & Porter, 1979; Fiegenbaum & Thomas, 1993; Porter, 1977). Indeed, if industry structure is to be viewed as subgroups of firms with distinct structural characteristics, then barriers to entry become partly specific to the strategic group rather than protecting all firms in the industry equally (Caves & Porter, 1977, Porter, 1979). Entry can be difficult into one strategic group and easy to another. As the number of firms and barriers to entry differ across groups, industrial organization theory predicts significant performance differences across strategic groups forming the industry. Mobility barriers offer a dual protection since they not only protect members of a strategic group from potential new entrants to the industry, but also deter inter-group mobility. Any factor that decreases the likelihood, scope, and speed of entry to a focal strategic group of potential new competitors in the industry and/or of firms belonging to other less protected groups constitutes a mobility barrier. Examples of mobility barriers include absolutes cost advantages and economies of scale, control of key inputs and vertical integration, patents, monopoly franchises, product differentiation and unfair competitive tactics. Typically, mobility barriers protecting the different strategic groups in the industry are asymmetrical ranging by degree of "height" from no barriers at all (free entry) to very high barriers that deny all entry. Firms belonging to a strategic group protected by high mobility barriers cannot easily be imitated by members of groups ranking lower on the mobility barriers hierarchy without substantial costs, long periods of time, or high uncertainty about the outcomes (McGee & Thomas, 1986). In stable industry environments, mobility barriers shield members of a strategic group from potential new entrants over a long period of time, while in highly dynamic environments, effective mobility barriers typically involve a series of temporary barriers (Dranove et al., 1998). High mobility barriers provide group members a chance to increase price above its long-run average cost without attracting new competition from outside. Therefore, by creating and preserving an imperfectly competitive environment, mobility barriers allow members of the most protected group to successfully exercise market power, hence to constantly outperform members of less protected groups. Following this line of reasoning, strategic group theory suggests that the presence of asymmetrical mobility barriers in an industry may offer an explanation as to why some firms persistently outperform others, and why firms embrace distinct strategies although not all strategies are equally successful (Porter, 1979).

Although theoretically compelling, the relationship between strategic group membership and firm performance has not received consistent empirical support. Several studies have found strong evidence for such a relationship (e.g., Ketchen, et al. 1993; Mascarenhas & Aaker, 1989; Nair & Kotha, 2001; Oster, 1982), but others have found only a small or non-significant association (e.g., Cool & Schendel, 1987; Frazer & Howell, 1983; Johnson & Thomas, 1988; Porter, 1979). Strong effects of strategic group membership on performance have been found in industries like the oil-drilling industry (Mascarenhas & Aaker, 1989) and the steel industry (Nair & Kotha, 2001), but not in others such as the medical supply and equipment industry (Frazier & Howell, 1983), the paint and allied products industry (Dess & Davis, 1984), the pharmaceutical industry (Cool & Schendel, 1987) and the U.K. brewing industry (Johnson & Thomas, 1988). In addition, the strength of the relationship appears to be highly sensitive to the research methodologies used. Findings vary according to the performance indicators used (profitability, growth, or stock performance), samples selected (single-industry vs. multi-industry), time frames adopted (cross-sectional vs. longitudinal), and definitions of resource configurations employed (broad vs. narrow) [Cool & Schendel, 1987; Dess & Davis, 1984; Ketchen et al., 1997; Lee & Yang, 1990; Lewis & Thomas, 1990]. In view of these results, recent strategic group research has shifted its attention towards the identification of the major moderating factors which may affect the extent of the relationship between strategic group membership and performance.

The present study builds upon Dranove et al., (1998), Bresnahan (1989) and Porter (1984) in suggesting that mobility barriers are necessary, but not sufficient, for maintaining long-standing above-normal strategic group profitability. An additional important determinant of profitability, even for groups protected from outsiders by very high mobility barriers, is the extent of within-group rivalry. Indeed, persistence of an imperfectly competitive environment in which group members can exercise market power involves two necessary conditions. First, group members should be shielded from *extra-group rivalry*, defined as the extent of competitive attacks and counterattacks originating from members of other groups and from firms outside the industry that are likely to enter and become actual competitors. Second, group members should be protected from the negative impact of *intra-group rivalry*, defined as the extent of competitive moves and countermoves instigated by firms belonging to the same group. Intense within-group rivalry negatively impact group members' profitability *ex ante* by increasing the costs of resource acquisition and *ex post* by increasing the cost of defending against product/market competitors (Schomburg, Grimm & Smith, 1994; Young et al., 1996). Hence, if we imagine a rank ordering of strategic groups forming the industry in terms of the height of their mobility barriers (high barriers, medium and roughly low), it is very likely that members of the group protected by the highest mobility barriers would be considerably insulated from *extra-group rivalry*. However, these mobility barriers provide little support when it comes to protecting group members from *intra-group rivalry*, i.e., aggressive price wars and other destructive competition which may arise among firms belonging to this group. If interfirm rivalry within the group protected by the highest mobility barriers is intense, the ability of group members to influence output prices will be weakened, and consequently, all potential advantages that might be generated by high mobility barriers protecting the group are likely to erode. In such situation, no performance differences across groups will be detected, despite the presence of asymmetrical mobility barriers in the industry. Hence, to significantly and persistently outperform other firms, members of the strategic group protected by the highest mobility barriers should be able to recognize their mutual dependence, and as a result, behave collusively rather than competitively. Therefore, the presence of effective mobility barriers obstructing most of extra-group competitive attacks is not sufficient for maintaining long-standing above-normal strategic group profitability. Both effective mobility barriers (condition 1) and intra-group cooperative behaviour (condition 2) are necessary conditions for group members to successfully establish higher prices, hence to significantly and persistently outperform other groups[2]. For example, in their analysis of the U.S. pharmaceutical industry, Cool & Dierickx (1993) reported three corroborating findings. First, firm performance was negatively affected by both within-group and

[2] Each of these conditions stresses one of the two conceptions of competition suggested in the competitive dynamics literature (Baum & Korn, 1996). The first condition, related to mobility barriers, focuses on "competition as a property of market structure whose nature is determined by market forces not subject to the conscious control of individual firms" (Baum & Korn, 1996: 255). That is, the focus here in on exogenous factors. The second condition emphasizes more on endogenous factors implied by the "conduct of individual firms" (Baum & Korn, 1996: 255).

between-group rivalry. Second, increasing rivalry was associated with changes in strategic group configuration and a concomitant shift from within group rivalry to between group rivalries. Third, this shift in patterns of rivalry had a significant impact on firm profitability. Cool and Dierickx's (1993) results suggest that conduct of strategic group members (i.e., degree of rivalry or collusion) affects significantly the performance implications of strategic group membership. Therefore, it is important to examine the set of behavioral implications to firm strategic group membership.

3. INTER-FIRM RIVALRY WITHIN STRATEGIC GROUPS

Both theoretical and empirical disagreements exist concerning the ability of members of the strategic group protected by the highest mobility barriers to create and maintain a relatively low degree of rivalry within the group. On the one hand, Caves and Porter (1977) argued that mutual dependence recognition and coordination are likely to be easily attained among members of the same strategic group. Driven by their resource and strategic similarity, firms belonging to the same group are likely to respond similarly to market opportunities and threats (Porter, 1979). As a result, members of the same group will be better able to predict their respective decision-making logic and to recognize their mutual dependence (Caves & Porter, 1977; Smith et al, 1997). Recognition of mutual dependence implies greater trust, which may facilitate information sharing, mutual understanding and coordination (Cool & Dierickx, 1993; Peteraf, 1993; Peteraf & Shanley, 1997; Smith et al, 1997). In addition, mobility barriers allow group members to distinguish between their group and other groups in the industry (Peteraf & Shanley, 1997). They provide some degree of temporal stability and perceived continuity to the group (Dranove et al., 1998). Accordingly, Caves and Porter (1977) suggested that mutual dependence recognition and coordination would be very high among members of the group protected by the highest mobility barriers.

On the other hand, the resource-based view of the firm predicts that members of the same strategic group, driven by their resource and strategic similarity, will be more inclined to dispute each other's sphere of interest, to challenge any above-normal rents and to embark in hostile price wars (Barney 1991; D'Aveni, 1994; Hatten & Hatten, 1987; Lei & Slocum, 1997; Peteraf, 1993). Similarly, industrial organization economics suggest that it becomes progressively more difficult to sustain tacit collusion and to limit costly competition inside strategic groups when there are a large number of firms within the group (Hirshleifer, 1980; Scherer & Ross, 1990), when firms within the group are of equal size (Kwoka & Ravenscraft, 1986), when the products supplied by group members are heterogeneous, complex, and changing (Scherer & Ross, 1990), when business conditions are depressed (Scherer & Ross, 1990), when group members depend on large or infrequent orders (Scherer & Ross, 1990), and when there is an absence of history, leadership or trust between group members (Scherer & Ross, 1990). In such situations, the ability of members of the group presumably protected by the highest mobility barriers to successfully exercise market power will be significantly reduced.

Hence, the occurrence of the second condition involving the persistence of a relatively low degree of rivalry among members of the group protected by the highest mobility barriers should not be taken for granted in all industry settings. In fact, members of such group may coordinate as tightly as if they were a genuine monopoly using cohesive group-pricing strategies, they may compete aggressively, they may simply ignore one another and pursue independent behavior, or they may follow an intermediate pattern. There are infinite varieties of such group members conduct, both in theory and in actual markets. In support for this argument, Smith et al., (1997) found that the severity of competitive moves and countermoves among firms cannot be predicted by their strategic group membership. Simply stated, condition 2 does not hold in all industry settings. This proposition may serve as an explanation for the puzzling empirical results reported earlier, suggesting that the level of support for the relationship between strategic group membership and firm performance varies across industries. Small or non-significant association between group membership and performance found in industries like the medical supply and equipment industry (Frazier & Howell, 1983), the paint and allied products industry (Dess & Davis, 1984), the pharmaceutical industry (Cool & Schendel, 1987) and the U.K. brewing industry (Johnson & Thomas, 1988) may be explained, at least in part, by the failure of members of the presumably most protected group to achieve oligopolistic coordination. On the other hand, strong relationships found in oil-drilling industry (Mascarenhas & Aaker, 1989) and the steel industry (Nair and Kotha, 2001) may indicate that firms belonging to the most protected group have succeeded to do so (that is, condition 2 holds in these two industries). Ketchen et al. (1997) findings, suggesting that the contribution of strategic groups to performance explanation were greater in studies that used single-industry samples designs, are also in line with my theoretical arguments. The noise introduced into the analysis by the use of research samples across multiple industries with potentially different levels of coordination inside the groups presumably protected by the highest mobility barriers (that is, condition 2 holds in some industries but not in others), unquestionably reduces the extent of performance variance explained by strategic group membership.

Thus, the extent of the contribution of strategic group membership in explaining performance variations across firms is very likely to be contingent upon the existence of specific factors which may facilitate the formation and maintenance of coordination among members of the group protected by the highest mobility barriers. The major barrier that members of highly protected strategic groups must overcome when trying to take advantage of mobility barriers is to maintain communication systems that allow them to coordinate their actions in their common interest (Stigler, 1964). Coordination is communication par excellence (Scherer & Ross, 1990: 176). Yet, the difficulty of developing communication systems rises exponentially as the number of firms within the strategic group increases. Moreover, firms need to develop alternative means of coordinating their behaviour without infringing antitrust law (Scherer & Ross, 1990; Stigler, 1964). But, first and foremost, firms belonging to the strategic group should put in place mechanisms for exposing and punishing group members that behave opportunistically (Jacquemin & Slade, 1989). Indeed, once cooperation and mutual forbearance bring about performance benefits, each group member has the incentive to secretly hold its own price just a little lower than the jointly agreed-upon price. The slightly lower price will increase the market share of the firm, and consequently, will improve its performance. However, as soon as other group members realize that the firm has behaved opportunistically, they will be inclined to reduce their own prices or at least punish the “cheater”. In this situation, coordination may well fall down, and group members may embark in aggressive price wars. Hence, because oligopolistic coordination among firms belonging to the highly protected group may easily collapse as a result of its own inner tensions, there should be a mechanism which allows group members to promptly detect, punish, and ultimately, discourage opportunistic behaviour.

In this research, I focus on the role played by two important mechanisms which may facilitate tacit coordination among group members. The first relies on market-based self-discipline, suggested by the mutual forbearance hypothesis. The second mechanism involves network-based self-discipline implied by the structural embeddedness perspective.

4. MULTIMARKET COMPETITION AND INTER-FIRM RIVALRY: THE MUTUAL FORBEARANCE HYPOTHESIS

Multimarket contact takes place when firms meet the same rivals in multiple markets (Gimeno & Woo, 1999; Karnani & Wernerfelt, 1985). A major focus of this research has been the extent to which multimarket competition is associated with greater competitive rivalry or greater cooperation and mutual forbearance. Although multimarket contact expands the opportunity that firms have to compete with each other, the higher market domain overlap does not necessarily translate into greater rivalry (Jayachandran, Gimeno & Varadarajan, 1999). Quite the opposite, the theory of multimarket competition proposes that the degree of rivalry between firms with high market domains overlap may be mitigated by a phenomenon known as "mutual forbearance" (Baum & Korn 1996;

Clark & Montgomery 1996; Edwards 1955; Gimeno & Woo 1996; Karnani & Wernerfelt 1985).

The rationale behind the mutual forbearance hypothesis is that firms with high multimarket contact have an extended scope for retaliation to aggressive moves initiated by the rival (Chen, 1996; Feinberg 1985; Gimeno & Woo, 1996). In situations where firms compete in multiple markets, they may be reluctant to challenge a particular market energetically because the potential of a gain in one market should be weighed against the risk of retaliatory actions in other markets (Chen, 1996; Edwards, 1955; Gimeno & Woo, 1996). Retaliatory actions can be directed to markets in which the retaliator's possible losses are minor compared with the attacker's, obliging the attacker to endure higher losses for its rivalrous behaviour (Baum & Korn, 1996; Chen, 1996; Gimeno & Woo, 1996). Therefore, compared with the single-market competition, multimarket competition expands the opportunities for retaliation by broadening the interdependence of firms from the time dimension (future) to the time and space dimensions (multiple markets) (Jayachandran et al, 1999).

Besides mutual deterrence, high multimarket contact may also improve firm's familiarity with the strategies of its competitors. Although under conditions of intense rivalry such knowledge might provide firms with important competitive intelligence, in the context of mutual forbearance such strategic familiarity may allow firms to more effectively lessen rivalry (Baum & Korn, 1996; DiMaggio & Powell, 1983; Jayachandran et al, 1999; Scott, 1982).

The hypothesis suggesting that high levels of multimarket contact may facilitate the evolution of coordination between rival firms has received considerable empirical support. For example, Baum & Korn (1996) and Gimeno and Woo (1996) found that airlines with extensive interroute contacts are less aggressive toward each other than those which meet in just few markets. Similarly, Evans and Kessides (1994) found that fares are higher in city-pair markets where the competing airlines have a high number of interroute contacts. This finding is also in line with empirical studies performed by Parker and Roller (1997) and Jans and Rosenbaum (1996) which revealed that multimarket contact is an important factor in explaining noncompetitive prices in the U.S. mobile telephone and cement industries. Hence, translated to the strategic group level of analysis, the arguments of the mutual forbearance hypothesis suggest that strategic group members are more likely to forbear from rivalrous behavior as the level of multimarket contacts among them increases. I argued earlier that the presence of high mobility barriers obstructing most of extra-group competitive attacks as well as the maintenance of a relatively low degree of within-group rivalry are necessary conditions for group members to successfully and persistently outperform other strategic groups. If the extent of multimarket contact among members of the strategic group protected by the highest mobility barriers is significant, then within-group coordination could be preserved and enhanced through the *mutual forbearance* phenomenon. Mutual forbearance originating from high multimarket contact provides a market-based self-discipline which promotes coordination and develops competitive norms of conduct regarding pricing and discount level among group members. Mobility barriers impede imitation, preserve the imperfectly competitive market conditions, delineate the boundaries of the group and increase the stability of the group over time (Dranove, et al. 1998). Through the interaction of mutual forbearance, which reduces intra-group competition, and mobility barriers, which limit extra-group competition, chances that members of the most protected group will successful take advantage of their strong market power are high. On the other hand, if the extent of multimarket contact among firms belonging to the group protected by the highest mobility barriers is low, then coordination among group members may not be easy to obtain particularly when the number of firms within the group is large, or when there is an absence of history, leadership or trust between group members (Kwoka & Ravenscraft, 1986; Peteraf & Shanley, 1997; Scherer & Ross, 1990).

With regard to firms belonging to groups ranking low on the mobility barriers hierarchy, it is very likely that the performance effects of within-group multimarket contact will be much lower than those of the highly protected group. Without effective mobility barriers preserving the imperfectly competitive conditions, those firms may not succeed to efficiently and persistently increase prices above long-run average costs. Low mobility barriers imply that the resource configurations characterizing a strategic group can be more easily emulated. Therefore, any marginal increase in prices above long-run average costs that might be generated by high multimarket contact will rapidly erode as it is likely to attract new competition from members of other groups and from firms outside the industry which may enter and become actual competitors.

In sum, I suggest that the extent of the relationship between strategic group membership and firm performance depends upon the level of within-group multimarket contact (Figure 1). More specifically, the ability of firms belonging to the strategic group presumably protected by the highest mobility barriers to persistently establish higher prices, and consequently to outperform other groups will be positively related to the extent of group-level multimarket contact. Hence, within-group multipoint competition should positively affect the performance of firms belonging to the group protected by the highest mobility barriers. On the other hand, within-group multipoint competition should have a weak effect on the performance of firms belonging to groups ranking low on the mobility barriers hierarchy. Therefore, I hypothesize:

Hypothesis 1: *All else being equal, within-group multipoint competition moderates the relationship between strategic group membership and performance.*

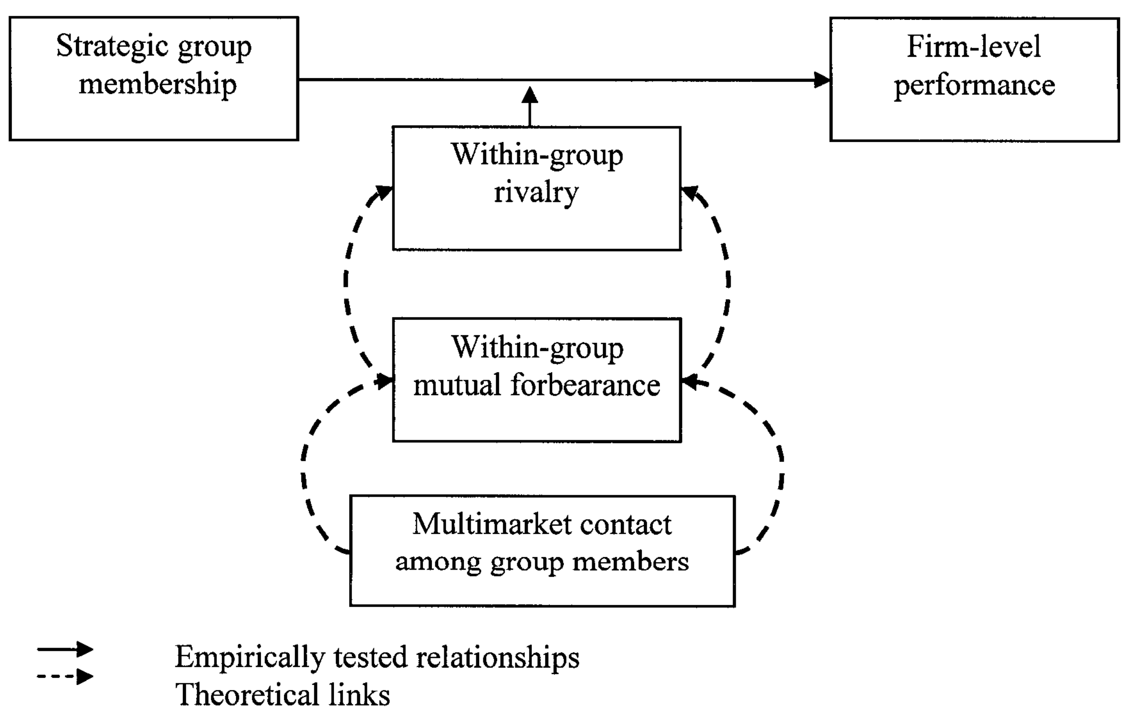

Figure 1: The moderating effect of within-group multimarket contact

Mainstream strategic group studies cluster firms sharing the same *attributes* (size, advertising intensity, R&D intensity) into groups, without regard for the structure of cooperative relationships in which these firms are embedded[3]. Such attribute analysis treats each firm as an astructural independent unit, which implies that it assumes that the firm has no strategic alliances at all, or at best, that the patterns of its intra-group and across-groups linkages are random. However the image of atomistic firms competing for profits against each other is increasingly inadequate (Gulati et al., 2000). Horizontal and vertical cooperative agreements among rival firms have increased considerably in number and in importance, particularly in knowledge-intensive industries. Firms are increasingly embedded in vast and non-random overlapping networks of social and economic ties with customers, competitors, universities, governments and other institutions (Granovetter 1985; Gulati et al., 2000). Networks in which firms are embedded may serve as unique and valuable conduits for many types of resources, information, referrals and influence (Burt 1992). On the other hand, networks have also a potential dark side reflected in lock in and lock out effects, which may lock firms into unproductive relationships or preclude them from partnering with other firms (Galaskiewicz & Zaheer, 1999; Gulati et al., 2000). To the extent that a firm's network of relationships is a source of both opportunities and constraints, aggregating each member's attributes independently of its network position obscures or destroys information about the sources of performance differences in the same way that centrifuging genes destroys structure while providing information about composition (Wellman, 1988). Hence, the next section introduces the important role of networks of inter-firm ties in understanding the fundamental issue of *when* strategic group membership affects firm performance.

[3] Nohria and Garcia-Pont (1991) and Garcia-Pont and Nohria (2002) studies are among the rare exceptions.

5. STRATEGIC NETWORKS AND INTER-FIRM RIVALRY: A STRUCTURAL EMBEDDEDNESS PERSPECTIVE

Although originally developed to understanding individuals' behaviour and their interpersonal networks, the main arguments of social network theory have been extended to organizations and their inter-organizational networks (Gulati, 1998, Mizruchi, 1994). The essence of social network theory lies in explaining, at least in part, how the pattern of cooperative ties among organizations in a network of relationships affects their behaviour and performance (Burt, 1994; Gulati, 1998; Laumann, Galaskiewicz & Marsden, 1978; Wellman, 1988). At the heart of social network theory is the assumption that the fundamental force driving the conduct of the firm in a particular situation lies in the set of constraints and opportunities imposed by the firm's structural position, defined by the pattern of, present and absent, ties the firm has with other organizations in the system (Burt, 1991). Therefore, the basic unit of analysis in network theory is the "relation", (e.g., the strategic alliance between two firms), as opposed to firm's "attributes" (e.g., size, advertising intensity, R&D intensity) used in conventional strategic management theory.

Three distinct characteristics of firms' network positions are likely to be relevant in connection with the ability of members of the strategic group presumably protected by the highest mobility barriers to enhance intra-group coordination: the density of direct ties maintained by group members, the extent of their role equivalence, and their centrality in the network.

5.1 Effect of Density of Ties

High density of direct cooperative relationships[4] among strategic group members promotes the development of two necessary prerequisite for effective oligopolistic coordination: efficient communication channels and trust inside the group (Gulati & Gargiulo, 1999; Scherer & Ross, 1990). Density of ties among firms belonging to the same strategic group refers to the relative number of relationships in the network that link group members together. Generally, it is calculated as a ratio of the number of relationships that exist among members of a particular group, compared with the total number of possible relationships (Rowley, 1997).

We can imagine two extreme scenarios illustrating the extent of density of ties among firms belonging to the same strategic group (Figure 2). At the one extreme, the network of ties is closed, meaning that all group members have relationships with each other (Bourdieu, 1980; Coleman, 1992). As relational ties between firms are channels for exchange of flow of information, a closed network provides group members with an efficient communication system, which may facilitate the achievement of oligopolistic coordination (Walker et al., 1997; Young et al, 1996).

Extensive direct relationships among group members offer not only opportunities to communicate efficiently, but also mechanisms through which trust and norms of equity

[4] Direct cooperative relationships refer to all types of agreements between independent firms over which flow information and resources in short or long terms. See Freeman (1991, p502) for a detailed typology of forms of cooperative agreements.

are diffused (Gulati, 1998; Shapiro, Sheppard, and Cheraskin, 1992). For example, Simmel's (1950) theory of trust draws attention to the importance of frequent interaction in enhancing trust or expectation of faithfulness. Similarly, Macaulay (1963) pointed to the pressures for conformity to expectations emerging from close personal ties developed between individuals in organizations involved in cohesive ties. Other research has stressed the important role of repeated interactions in promoting mutual affect and familiarity (Gulati & Westphal, 1999; Gulati, 1995; Laumann, Galaskiewicz, & Marsden, 1978). Further, Oliver (1991) has also illustrated how dense networks establish relational channels through which institutional norms and values may be diffused. Hence, cohesive ties implied by closed networks reduce uncertainty, promote trust regarding future agreements, and allow group members to detect new opportunities for cooperation that would be impossible to recognize outside of a close relationship (Gulati & Gargiulo, 1999; Gulati, 1998; Peteraf & Shanley, 1997; Podolny, 1994).

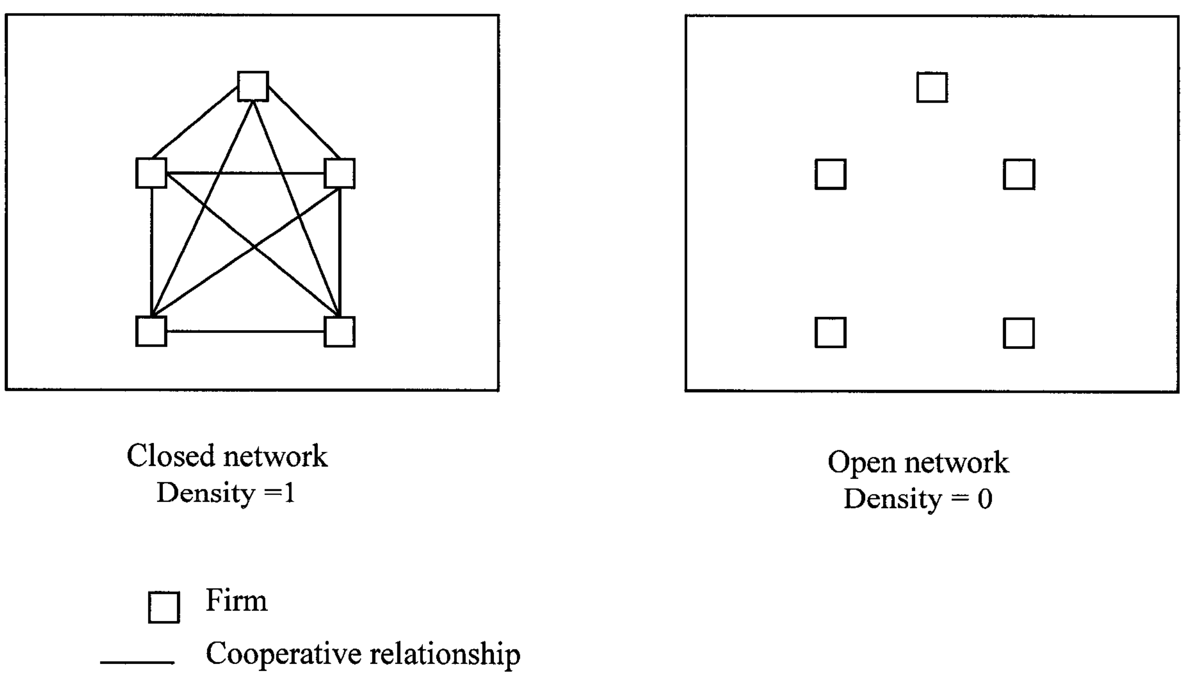

Figure 2: Two extreme cases of density of ties

Along with fostering efficient communication systems and diffusing shared norms and values, closed network structures provide firms with the opportunity to lower transaction costs by making opportunism more costly (Gulati et al., 2000; Gulati, 1998). Closed networks can generate a reputational lock-in, since any opportunistic behavior by a group member may be reported to other members (Gulati & Gargiulo, 1999; Raub & Weessie, 1990). As firm's reputation takes time to build but can be broken rapidly, closed networks can establish an effective deterrent for opportunistic behaviour (Brass, Butterfield & Skaggs, 1998; Gulati et al., 2000). Moreover, as information about one member opportunistic behaviour diffuses rapidly to other firms belonging to the same group, sanctions for deviant behaviour are more easily imposed (Ahuja, 2000; Brass, Butterfield & Skaggs, 1998; Walker et al., 1997). In sum, group members embedded in highly interconnected networks have access to *social capital*, a resource that encourages conformity in norms (Rowley, 1997) and promotes cooperation (Walker et al., 1997).

At the other extreme is an "open" network, in which group members do not have direct cooperative relationships with each other. In such an open network, members of the group cannot rely on social capital to establish trust and conformity in norms. As a result, effective coordination among group members is less likely to emerge. Certainly, the structure of network relationships among strategic groups is very unlikely to be neither completely closed nor totally open (Nohria & Garcia-pont, 1991). The above arguments clearly suggest, however, that as density of within-group ties increases, social capital available to group members expands, thereby promoting the development of key conditions necessary for effective oligopolistic coordination.

Hence, when the density of cooperative relationships among members of the group protected by the highest mobility barriers is significant, within-group coordination could be sustained through the resultant social capital (Figure 3). Social capital emerging from cohesive ties among members of the strategic group offers an effective network-based self-discipline mechanism which fosters communication, trust and coordination inside the group. Mobility barriers impede imitation, preserve the imperfectly competitive market conditions, delineate the boundaries of the group and increase the stability of the group over time (Dranove, et al. 1998). Through the interaction of these two stimulators, chances that group members will choose to formulate strategic moves in concert are enhanced. For example, using a prisoner's dilemma framework Raub and Weesie (1990) illustrated how a firm embedded in cohesive ties is constrained to be more cooperative than a similar firm embedded in an open network. Adopting a more qualitative approach, Granovetter (1985) has convincingly showed how cohesive networks promote inter-organizational cooperation. Eccles and Crane (1988) and Podolny (1993) have also illustrated how the linkages between the top-tier investment banks preserve the above-normal profitability of the industry. More recently, Dranove et al., (1998), Guedri (2002) and Guedri and McGuire (2003) have pointed to the positive market power, efficiency and differentiation effects that may be generated from extensive interaction among strategic group members. Similarly, many scholars have suggested that cooperative agreements among group members reduce environmental uncertainty and ambiguity faced by these firms. In particular Dodgson (1993), Singh (1997) and Reuer and Lieblein (2000) observe that since strategic alliances have option-like characteristics, they allow involved partners to significantly reduce their downside risk as well as the volatility of their returns. Finally, in their longitudinal analysis of the Hollywood film industry, Baker and Faulkner (1991) described how the evolution in the pattern and density of ties among industry participants has affected firms' profitability. On the other hand, when the density of cooperative relationships among members of the most protected strategic group is low, oligopolistic coordination may not be easy to achieve (Hirshleifer, 1980; Kwoka & Ravenscraft, 1986: Peteraf & Shanley, 1997; Scherer & Ross, 1990).

With regard to firms belonging to groups ranking low on the mobility barriers hierarchy, high within group density of ties may endow group members with efficient communication channels, enhanced bargaining power and other coordination mechanisms. However, without the support of effective mobility barriers impeding imitation and preserving the imperfectly competitive market conditions, the impact of these potential effects on the performance of member firms is expected to be much lower than in the case of highly protected groups. Therefore, I hypothesize:

> **Hypothesis 2:** *All else being equal, within-group density of ties moderates the relationship between strategic group membership and performance.*

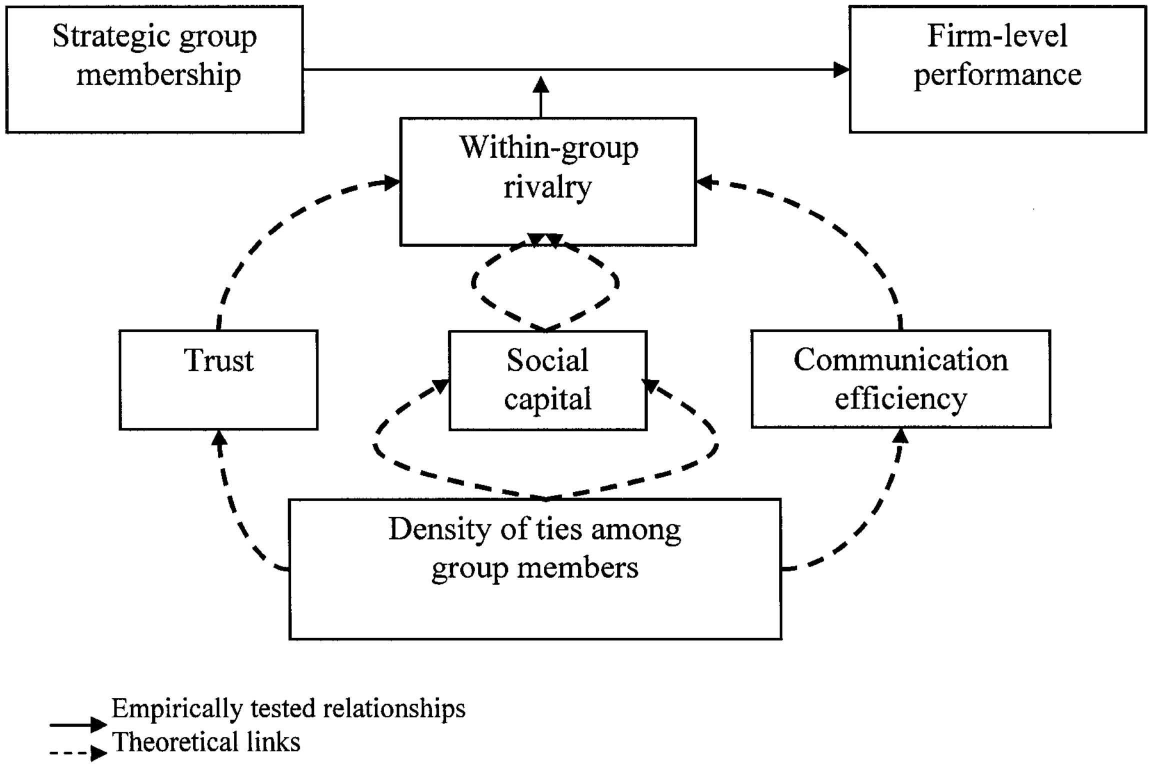

Figure 3: The moderating effect of within-group density of ties

5.2 Effect of Role Equivalence

Direct cooperative relationships among strategic group members are not the only way through which oligopolistic coordination within the group might be sustained. Trust and cooperation among firms may also emerge via *symbolic* communication triggered by the "role" associated with the structural position occupied by these organizations in the overall network (Galaskiewicz & Burt, 1991; Gulati, 1998; Mizruchi, 1993). At the heart of this perspective is the assumption that a firm's "*role*" can be captured by its structural *position,* defined by the pattern of present and absent ties the firm has with other organizations in the system. In sociological terms, the notion of "role" refers to the set of behaviours expected from, and anticipated by, an actor (e.g., organization) occupying a particular position in a social structure (Baker & Faulkner, 1991:280; Homans, 1967: 11). Hence, two organizations would have the same "role" to the extent that their patterns of relationships with other organizations are similar (Burt, 1991; Mizruchi, 1994; Wasserman & Fraust, 1994). In this case, the two organizations would be viewed as *role equivalent*[5] (Gulati & Gargiulo, 1999; Mizruchi, 1994). In contrast, two organizations are not role equivalent to the extent that they have distinct ties with each organization in the system (Burt, 1980). Role equivalent organizations do not have to be connected to the same other organizations, but instead need only be involved in similar types of interactions with similar types of organizations (Mizruchi, 1994). Moreover, role equivalent firms may not be directly connected to each other. For example, in the network depicted in figure 4, firms A and B, as well as H and E, are role equivalent because their patterns of relationships with other organizations in the network are identical. For the same reason, firms C, D, F, G, I and J are also role equivalent.

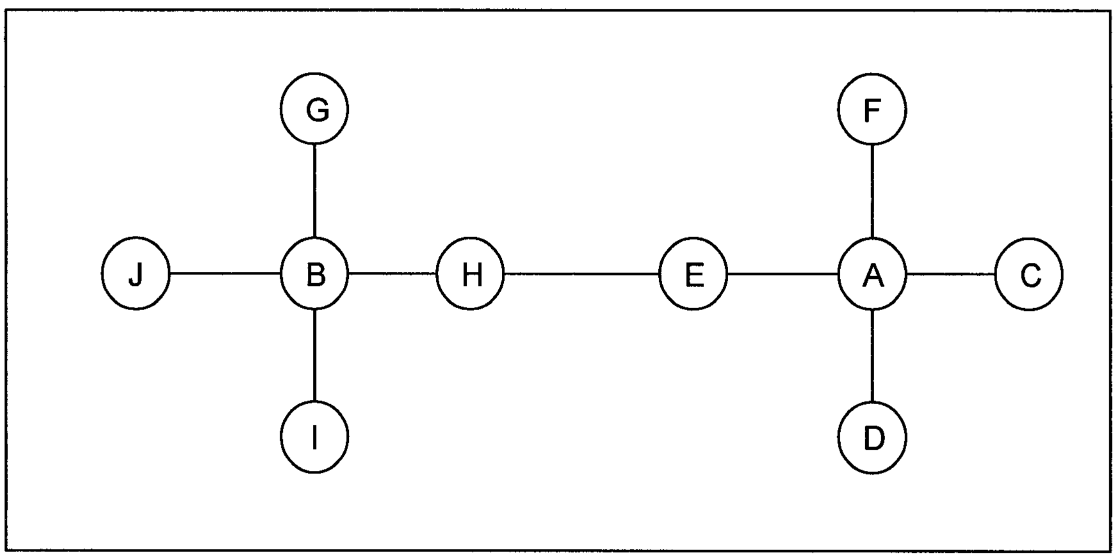

Figure 4: Example illustrating role equivalent organizations

[5] I focus on role-equivalence models rather than structural equivalence models because they more adequately capture status/role an actor occupy in the overall network (Borgatti and Everett 1992, Gulati & Gargiulo, 1999; Mizruchi 1994).

Conformity in norms, values and behaviours among role equivalent organizations rests on two theoretical arguments. The socialization argument suggests that equivalent organizations should display similar norms and behaviours because such firms tend to interact with the same types of other organizations in the same manner (Burt, 1983; Ibarra & Andrews, 1993). The symbolic argument suggests that equivalent organizations are likely to have similar norms and behaviours because these firms actively model themselves on each other and frequently play one another's roles as they build an opinion (Burt, 1983; Ibarra & Andrews, 1993).

At a strategic group level of analysis, we can illustrate the extent of role equivalence among firms belonging to the same strategic group with two opposite cases. At the one end, all pairs of firms belonging to the strategic group are role equivalent. In such a situation, the socialization and the symbolic arguments outlined above would suggest that group members would look to one another as significant referents (Burt, 1983; Ibarra & Andrews, 1993). This in turn, would facilitate mutual understanding, mutual modeling, and identification processes among strategic group members, thereby reducing the likelihood of competitive attacks and confrontations between them (Gnyawali & Madhavan, 2001; Peteraf & Shanley, 1997). The signalling effect of role equivalence is particularly important in uncertain environments (Gulati, 1998, Podolny, 1994).

At the other end is a situation in which all pairs of firms belonging to the strategic group are not role equivalent. In this case, group members occupy distinct structural positions in the system, which implies that they are separated by high structural distance[6]. Here, mutual understanding and coordination are less likely to emerge among members of the strategic group because firms cannot rely on the socialization and symbolic communication processes implied by the role associated with a common structural position (Galaskiewicz & Burt, 1991; Gulati, 1998; Mizruchi, 1993). Under those circumstances, coordination may not be easy to attain among firms belonging to the strategic group.

Returning to the strategic group protected by the highest mobility barriers, the aforementioned arguments suggest that role equivalence provides another network-based self-discipline mechanism, which, combined with effective mobility barriers, allow group members to achieve oligopolistic coordination, and hence, to persistently outperform members of other groups (Figure 5). In contrast, the impact of role equivalence among firms belonging to other less protected strategic groups on their performance is likely to be much lower than in the case of highly protected groups. Without effective mobility barriers hindering imitation and maintaining the imperfectly competitive market conditions, those firms may not succeed to overturn their unfavourable market position. Therefore, I hypothesize:

> **Hypothesis 3:** All else being equal, within-group role equivalence moderates the relationship between strategic group membership and performance.

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[6] Zero distance separates role equivalent organizations. Two firms are not equivalent if they are separated by high distance.

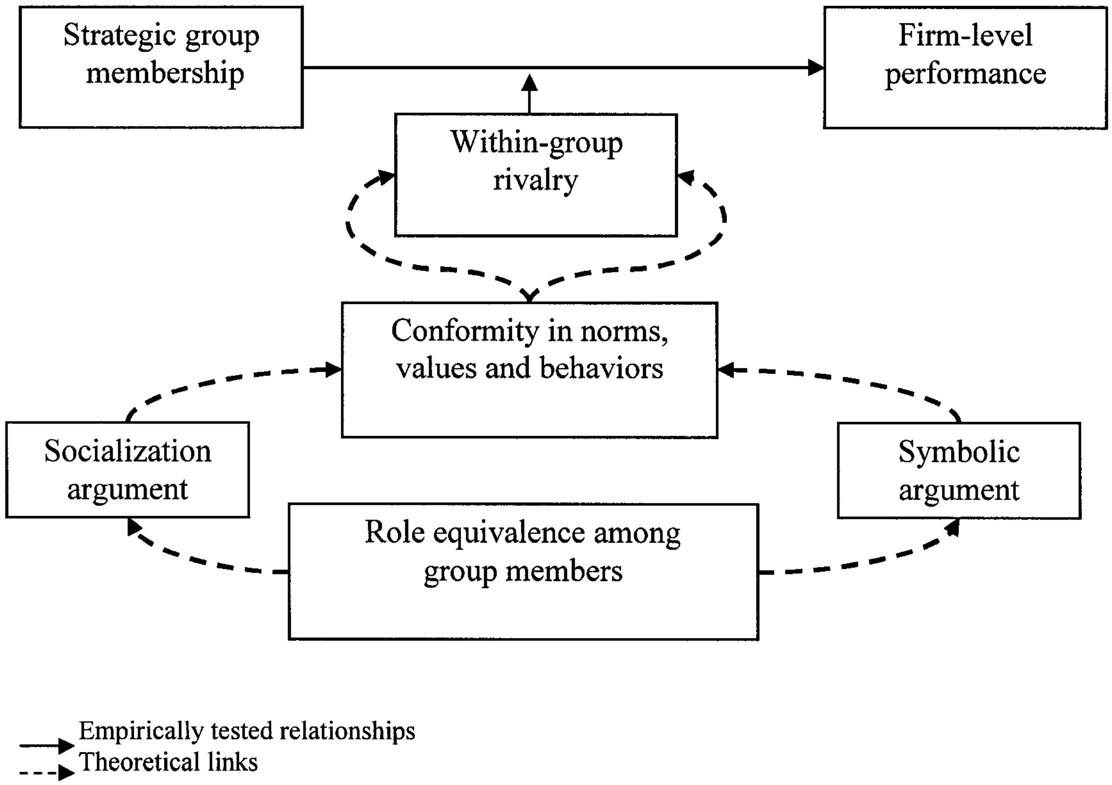

Figure 5: The moderating effect of within-group role equivalence

5.3 Effect of Centrality

The competitive dynamics literature suggests that firms with similar resource endowment are less likely to initiate an attack on each other (Chen, 1996; Chen & MacMillan, 1992). Before initiating a competitive move, a focal firm will first evaluate its own ability of attacking in comparison with potential defender's aptitude of retaliation since the ultimate effectiveness of the move depends largely on defender's response (Chen, 1996; Smith et al., 1992). As defenders with resource endowments similar to those of the attacker are most capable of harmful retaliation, then it is expected that resource similarity will lessen the likelihood of inter-firm rivalry (Chen, 1996; Chen &

MacMillan, 1992). A firm's capability for attacking or defending is a function not only of internal stock of resources, which resides within its "boundaries", but also of external resources, which could be mobilized through its existing set of network relationships (Chamberlin, 1968; Galaskiewicz, 1979; Gnyawali & Madhavan, 2001; Lenz, 1980; Young et al., 1996). Gulati (1999: 398) refers to these external resources as "network resources". Following this reasoning, it is likely*, all else being equal,* that rivalry inside a strategic group will be a function of group members heterogeneity in network resources since firms belonging to the same strategic group are, by definition, homogeneous in terms of internal resources. When network resources of members of the same strategic group are comparable, group members' total resources are likely to be homogeneous. In this situation, intra-group rivalry is expected to be low since firms with similar resource endowments are less likely to initiate attacks on each other (Chen, 1996; Chen & MacMillan, 1992). However, when group members' network resources are disparate, heterogeneity in terms of total resources will increase the likelihood of rivalrous conduct within the group (Gnyawali & Madhavan, 2001).

Network theory suggests that firm's access to, and potential control over, relevant network resources may be captured by the centrality of its position in the overall system of relationships (Brass & Burkhardt, 1993; Freeman, 1979; Knoke & Kuklinski, 1982; Shah, 2000; Wasserman & Faust, 1994). Centrality reflects the significance of the firm in its network by virtue of being involved in a large number of relationships (Burt, 1991; Gnyawali & Madhavan, 2001; Wasserman & Faust, 1994). A highly central firm can gain access to assets, information, and knowledge that cannot be secured internally, since network ties are conduits for these three resources (Gnyawali & Madhavan, 2001; Gulati, 2000; Powell & Brantley, 1992). Moreover, highly central organizations have a larger "intelligence web" through which they can receive new information, knowledge and assets *sooner* than less central firms (Burt, 1992; Gnyawali & Madhavan, 2001; Gnyawali et al., 2002; Gulati & Gargiulo, 1999; Rogers, 1995). Further, more reliable information is obtained when various redundant sources are accessed (Rowley et al., 2000; Shannon. 1957). While a cooperative relationship may provide a focal firm with an opportunity to access information, it may also represent a possible information leakage conduit, which may negatively affect highly central firms (Harrigan, 1986). However, Gnyawali and Madhavan (2001) argue that even in such situation, central firm will still have the advantage, on balance, because disjointed information received by peripheral firms may be less useful than the integrated information set held by central firms. The information, knowledge and asset advantages resulting from centrality are complemented by the higher visibility, prestige and status of central organizations (Gulati & Gargiulo, 1999). Indeed, as central firms are involved in numerous direct and indirect relationships, they may be viewed as having something of value to offer (Gnyawali & Madhavan, 2001; Gulati & Gargiulo, 1999). Finally, given that strategic alliances have option-like characteristics, a highly central firm is in a better position to confront environmental uncertainty and ambiguity, which allows the firm to significantly reduce the volatility of its returns (Dodgson, 1993; Reuer & Lieblein, 2000; Singh, 1997).

At a strategic group level of analysis, we can imagine two scenarios illustrating the extent of heterogeneity among group members in terms of their network centrality. In the first scenario, firms belonging to the strategic group protected by the highest mobility barriers are comparable in terms of network centrality. In this case, group members will be homogeneous in both internal and network resources, which implies that they will be less likely to adopt intensive rivalrous conduct against each other (Chen, 1996; Chen & MacMillan, 1992; Gnyawali & Madhavan, 2001). On the hand, if firms belonging to the strategic group protected by the highest mobility barriers occupy very distinct positions in terms of centrality, then their resource heterogeneity will increase the likelihood of aggressive competitive moves against each other (Chen, 1996; Chen & MacMillan, 1992; Gnyawali & Madhavan, 2001). In such situation, barriers to oligopolistic coordination may not be easy to overcome for firms belonging to the most protected group (Figure 6).

While high homogeneity in terms of centrality among firms belonging to other less protected strategic groups may lessen within-group rivalry, it is likely that its effects on the profitability of member firms would be much less meaningful than in the case of highly protected groups. Indeed, without effective mobility barriers impeding imitation and preserving the imperfectly competitive market conditions, low rivalry is unlikely to produce sustainable positive performance effects.

Therefore, I hypothesize:

> **Hypothesis 4:** *All else being equal, within-group heterogeneity in terms of network centrality moderates the relationship between strategic group membership and performance.*

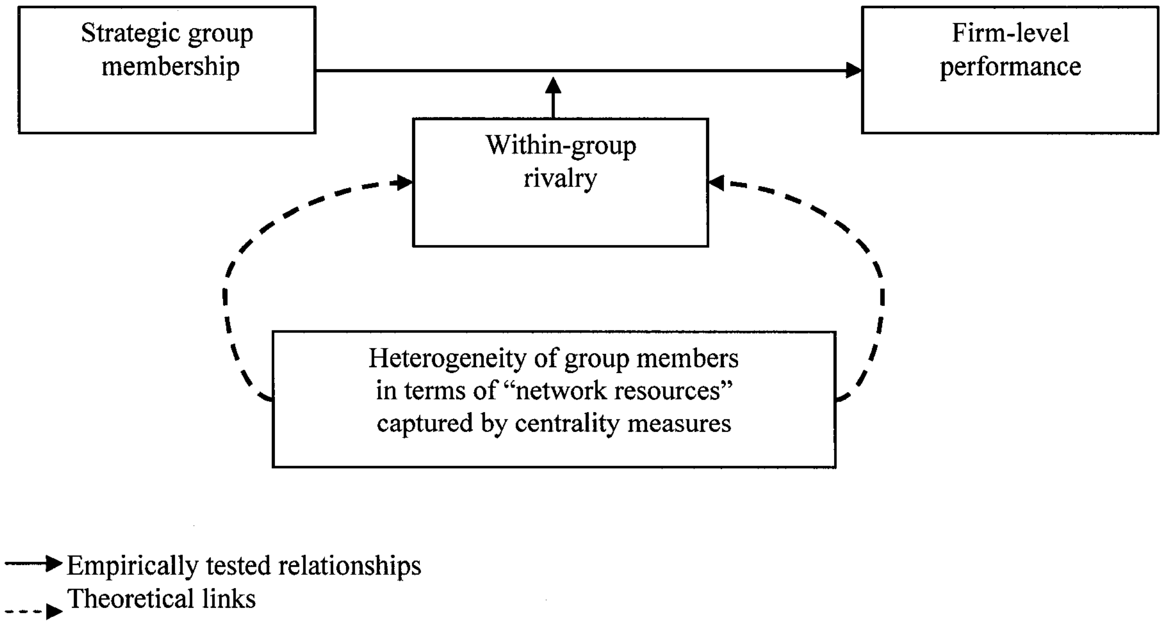

Figure 6: The moderating effect of within-group heterogeneity in terms of network centrality

6. METHODS

6.1 Research Setting, Samples and Data Sources

I tested the moderating effect of within-group multimarket competition on the relationship between strategic group membership and firm performance (hypothesis 1) using two samples drawn from the pharmaceutical and the automotive industries. In addition, I tested the moderating effects of within-group density of ties (hypothesis 2), within-group role equivalence (hypothesis 3) and within-group centrality heterogeneity (hypothesis 4) on the performance consequences of strategic group membership using two samples from the pharmaceutical and the airline industries. I was not able to test hypothesis 1 in the airline industry context because reliable data on multimarket contact was not available. For the same reason, it was not possible to examine the moderating effect of alliance networks on the performance consequences of strategic group membership in the automotive industry as reliable alliance data was not obtainable.

With regard to the pharmaceutical industry, the sample consisted of 68 U.S, European and Japanese pharmaceutical firms. These firms accounted for more than 80 percent of total sales in the U.S. prescription drug market over the period examined (1997-2000). The four-year period 1997-2000 was selected because the Bartlett χ^2 test, examining the stability of the variance-covariance matrices of the strategic variables across the years, revealed that the period 1997-2000 was a Strategically Stable Time Period (Cool & Schendel, 1988; Fiegenbaum, Sudharsan & Thomas, 1990). Bloomberg, StockVal, Standard & Poor's Compustat and Worldscope were the primary source of data on financial variables. Product-market data were obtained from the FDA's "Approved Drug

Products with Therapeutic Equivalence Evaluation" orange book, from the National Drug Code Directory (NDCD), and from other sources such as Physician's Desk Reference, IMS Health, CenterWatch, PhRMA and annual reports. Information on firm patent stock was collected from the U.S Patent and Trademark Office (USPTO). Finally, the principal source of strategic alliance data was Bioscan.

For the automotive industry, the sample included 20 global car manufacturers. These firms accounted for more than 98 percent of automobile sales in the United States over the period under study 1991-1997. This time frame was adopted because it represented a Strategically Stable Time Period (Cool & Schendel, 1988; Fiegenbaum, Sudharsan & Thomas, 1990). The primary sources of financial data were Standard & Poor's Compustat, Worldscope and Disclosure. Product-market was obtained from World Motor Vehicle Data, Motor Age, U.S Auto Industry Report and Ward's Automotive Yearbook.

Finally, the third sample consisted of 75 international air carriers from 53 countries. These airlines accounted for more than 70 percent of the worldwide international passenger-kilometres performed over the Strategically Stable Time Period 1996-2000 (Cool & Schendel, 1988; Fiegenbaum, Sudharsan & Thomas, 1990). Statistics relating to international air traffic, routes and tariffs published by the International Civil Aviation Organization (ICAO) constituted the primary data source. Data on strategic alliance was gathered from annual surveys published by Airline Business. Details on all bilateral air service agreements in action during the period of study were obtained from different editions of the "Digest of bilateral air transport agreements" and the "Aeronautical agreements and arrangements: tables of agreements and arrangements registered with the organization" published by the ICAO. Finally, macro economic data was collected from the World Development Indicators (WDI) database compiled by the World Bank Group.

6.2 Dependent Variables

In measuring firm performance, I have attempted to take into account the various distinctive characteristics (e.g., industry life cycle, R&D intensity, geographic scope of competition, production or service) of each industry studied. Therefore, I did not use the same performance indicator in all three industries investigated. In the context of the airline industry, I captured firm performance using the passenger-load factor index. Passenger-load factor index is defined as the ratio of passenger-kilometres (scheduled and charter) to available seat-kilometres (Schefczyk, 1993). The arguments in favour of the use of passenger-load factor index instead of other traditional profitability measures such as return on assets or return on equity are numerous. Indeed, because our sample included firms from 53 countries, using traditional accounting profitability measures would undoubtedly have produced biased results due to persistent national differences in accounting methods, enduring disparities in airlines' cost of capital, and high sensibility to currency fluctuations (Burgers, 1993). Moreover, it was not possible to use market performance measures such as Tobin's q because many international air carriers are not public companies.

In the context of the pharmaceutical industry, I measured firm performance using the price to book ratio. This ratio compares the market capitalization of a firm to its value as indicated on financial statements. A price to book ratio greater than one suggests that a firm is generating above-normal value, while a ratio smaller than one suggests that a firm is generating below-normal value. I have preferred the price to book ratio to other simple accounting measures such as ROA or ROE for two important reasons. First, accounting standards have a built-in short-term bias since they generally stipulate that R&D expenditures, which are in essence investments for the future, should be considered for accounting purposes as expenses in the calculation of firm profitability results (Barney, 2001; Grossman & Hoskisson, 1998). Because the pharmaceutical industry is R&D intensive and because stock markets are perceived to be more forward looking, the price to book ratio may be considered as a better indicator of pharmaceutical companies' performance (Grossman & Hoskisson, 1998). The second drawback of simple accounting profitability measures is that they typically fail to appreciate a firm's intangible R&D resources and capabilities (Barney, 2001). As the price to book ratio combines accounting information with market information which is likely to incorporate an assessment of important R&D intangible capabilities, it is generally viewed as a more accurate performance measure than simple accounting ratios.

Finally, following prior research investigating automobile manufacturers' competitiveness (Fuss & Waverman, 1992; Zaman & Unsal, 2000) I measured firm performance in the automotive industry using the net income margin ratio. Net income margin is defined as total net income divided by revenue, expressed as a percentage.

6.3 Independent Variables

Firm Strategic Group Membership. The determination of firm strategic group membership in each of the three industries under study involved two primary steps. First, strategic variables capturing different mobility barriers present in an industry were theoretically specified. These strategic variables were identified after a careful examination of academic literature, industry surveys, 10-K reports and published interviews of industry experts. Next, two different clustering algorithms were used in order to empirically determine firm strategic group membership and to theoretically assess height of mobility barriers protecting each strategic group. These algorithms cluster firms together in a manner so that the statistical variance among firms grouped together is minimized while between-group variance is maximized.

Consistent with previous research in the pharmaceutical (Bogner et al., 1996; Cool & Schendel 1987, 1988), the automotive (Garcia-pont & Noria, 2002; Nohria & Garcia-pont, 1991) and the airline (Peteraf, 1993; Veliyath & Ferris, 1997) industries, I identified strategic groups in each of these industries using the following variables tapping resource commitments likely to create mobility barriers protecting group members from outside competition.

The pharmaceutical industry

The high uncertainty, high asset specificity and high sunk costs associated with developing R&D expertise necessary to maintain a continuous flow of new innovative drugs represent incontestably the most important mobility barrier facing pharmaceutical firms. Indeed, on average, developing a new medicine takes 10 to 15 years and costs $802 million (Phrma, 2002). Moreover, it is estimated that only 1 of 5,000 screened compounds is approved as a new medicine and, of these, only 3 of 10 marketed drugs produce revenues that match or exceed average R&D costs (Phrma, 2002). I measured firm R&D expertise using four proxies. The first measure, *therapeutic innovation,* denotes firm's capabilities in developing medicines which provide significant clinical improvements over existing drugs. Breakthrough drugs offering significant therapeutic added value are classified by the FDA as priority drugs because they qualify for the fast priority review. Hence, I defined therapeutic innovation as the cumulative number of priority drugs introduced by the firm over a 3 years period. The second measure, *radical innovation*, refers to firm's capabilities in introducing medicines including totally new active ingredients that have never before been approved for the U.S. market (Yeoh & Roth, 1999). The FDA classifies these medicines as New Molecular Entity (NME) drugs. Accordingly, I defined radical innovation as the cumulative number of NMEs introduced by the firm over a 3 years period. The third measure, which captures firm's richness of patent portfolio, was defined as the cumulative number of patents issued by the USPTO to the firm over a 3 years period. Only patents belonging to classes related to pharmaceutical products were included in the count[7] (Bogner, Thomas & McGee, 1996). The fourth measure used to assess firm technological expertise reflects company depth of portfolio in terms of route of administration offered. Route of administration refers to the way a drug can be administered to the patient (i.e., oral, intramuscular, intravenous,

[7] Following Bogner, Thomas and McGee (1996), we considered only patent classes 423, 424, 435, 436, 514, 530, 800 and 935.

etc...). I operationalized firm's portfolio depth as the total number of routes of administration offered by drugs marketed by the company.

Mobility barriers might also be created via predatory pricing behavior made possible by firm's extensive diversification and internationalization. Predatory pricing refers to sustained price cutting intending to force existing competitors to exit the market or discourage potential competitors from future entry. Highly diversified firms have greater opportunity and ability to use predatory pricing as an effective competitive weapon because they can fund short-term losses resulting from price cuts through cross-industry subsidization (Palich, Cardinal & Miller, 2000). This effective competitive weapon is largely unavailable to focused rivals. Similarly, predatory pricing is an option for firms competing on a global geographical scale since profit sanctuaries may offer these firms both the ability and opportunity to use cross-market subsidization (Gupta & Govindarajan, 2001; Tallman & Li, 1996; Yip, 1995). Hence, extensive diversification and internationalization might deter entry by building a reputation for predatory behavior and by signaling to group outsiders that a predatory pricing move would be the retort to any new entry. I measured firm diversification using the sum of the number of industries in which the company competed, as indicated by four-digit SIC codes. Moreover, I operationalized the extent of firm internationalization as the proportion of sales generated from operations in foreign countries to total firm sales.

Economies of scale may deter entry by forcing new firms to either concede a cost disadvantage or enter on a large scale in terms of production and R&D. To proxy firm's ability to exploit economies of scale in production activities I employed two measures: firm's total assets and total number of drugs marketed by the firm. In addition, I used the ratio R&D to sales to capture realized economies of scale related to R&D activities.

In an industry like the pharmaceutical industry where the knowledge base is complex, expanding and broadly distributed, the locus of innovation may reside within networks of learning rather than in individual firms (Powell, Koput, Smith-Doerr, 1996). The considerable time, money and uncertainty associated with developing unique and extensive network resources often represent a significant barrier for firms desiring to compete in the research-intensive side of the industry (Anand & Khanna, 2000). I measured firm access to networks of learning using Stephenson and Zelen (1989) information index.

I identified firm strategic group membership for each year using the accepted two-stage clustering procedure proposed by Ketchen & Shook (1996). First, I employed Ward's hierarchical algorithm to define the number of clusters. Next, I used a k-means algorithm to determine the strategic group membership of each pharmaceutical firm for each year. All ten strategic variables used in both cluster analyses were standardized. This clustering procedure revealed the presence of three distinct strategic groups over the period 1997-2000. Table 1 summarizes the main characteristics of each strategic group as related to the strategic variables. In addition, firm strategic group membership over the period 1997-2000 is found in Table 2.

Table 1: Characteristics of strategic groups in the pharmaceutical industry

Strategic variable	**Group 1**	**Group 2**	**Group 3**
Patent stock	Well above average	Below average	Below average
Therapeutic innovation	Well above average	Below average	Below average
Radical innovation	Well above average	Below average	Below average
Information index	Above average	Above average	Below average
Diversification	Above average	Below average	Average
Internationalization	Above average	Below average	Average
R&D intensity	Average	Well above average	Below average
Total Assets	Well above average	Below average	Average
Number of drugs marketed	Above average	Below average	Average
Routes of administration offered	Above average	Below average	Average
Mobility barriers protecting the strategic group	**Very high**	**Moderate**	**Fairly low**

Table 2: Firm strategic group membership in the pharmaceutical industry over the period 1997-2000

Firm	1997	1998	1999	2000
Abbott	1	1	1	1
Akorn	3	3	3	3
Allergan	3	3	3	3
Alpharma	3	3	3	3
Altana	3	3	3	3
Alza	2	3	3	3
Amarin	2	2	2	2
Amgen	2	2	2	3
AstraZeneca	1	1	1	1
Aventis	1	1	1	1
Barr Laboratories	2	3	3	3
BASF	3	3	3	3
Bausch & Lomb	3	3	3	3
Baxter	3	3	3	3
Bayer	1	1	1	1
Biogen	2	2	2	2
Biovail	3	3	2	2
Boehringer Ingelheim	1	1	1	1
Bristol-Myers Squibb	1	1	1	1
Chiron	2	2	2	2
Draxis Health	2	3	3	3
Eisai	3	3	3	3
Elan	3	3	2	3
Forest Laboratories	2	3	3	3
Fujisawa	3	3	3	3
Genentech	2	2	2	3
Genzyme	3	3	3	3
Gilead	2	2	2	2
Glaxo Wellcome	1	1	1	1
Halsey Drugs	3	3	3	3
Hi Tech Pharmacal	3	3	3	3
ICN Pharmaceuticals	3	3	3	3
Immunex	2	2	2	3
IVAX	3	3	3	3

Firm	1997	1998	1999	2000
Johnson & Johnson	1	1	1	1
King Pharmaceuticals	2	3	3	3
KV Pharmaceutical	3	3	3	3
Lilly	1	1	1	1
Mallinckrodt	3	3	3	3
Medicis Pharmaceutical	2	2	3	3
MedImmune	2	2	2	3
Merck	1	1	1	1
MGI Pharma	2	2	2	2
Mylan Pharmaceuticals	2	3	3	3
Novartis	1	1	1	1
Noven Pharmaceuticals	2	2	2	2
Novo Nordisk	3	3	3	3
Organon	3	3	3	3
Pfizer	1	1	1	1
Pharmacia & Upjohn	1	1	1	1
Roche	1	1	1	1
Sanofi	3	1	3	3
Santen Pharmaceutical	3	3	3	3
Schering AG	3	3	3	3
Schering-Plough	3	3	3	3
Schwarz Pharma	3	3	3	3
Searle	3	3	3	3
Serono	3	3	2	3
Shire Pharmaceuticals	2	2	2	3
Sicor	2	3	3	3
Takeda	3	3	3	3
Taro Pharmaceuticals	3	3	3	3
Teva Pharmaceutical	3	3	3	3
UCB	3	3	3	3
Watson Pharmaceuticals	2	2	2	3
Vivus	3	3	3	3
Wyeth-Ayerst	1	1	1	1
Yamanouchi	3	3	3	3

The first cluster, which included large research-intensive multinational firms, ranks incontestably at the top of the hierarchy in terms of mobility barriers height. Indeed, this group of firms known as the "Big League" (Taggart, 1993) showed by far the highest scores of the industry in terms of patent stock, therapeutic innovation, radical innovation, portfolio depth in terms of routes of administration offered, network centrality, diversification, internationalization and size. The resource mass efficiencies, resource erosion, time compression diseconomies and causal ambiguity underlying these strategic dimensions allow group members to systematically increase price above its long-run average cost without attracting new competition from outside the group.

The second strategic group consisted exclusively of biopharmaceutical firms marketing a small number of patent-protected drugs. Although these firms possess significant technological expertise in the market niche using recombinant DNA technology, their small size and limited diversification and internationalization put them in a weaker competitive position relatively to "Big league" members.

Finally, the third strategic group consisted of firms marketing either generic (off-patent) or "me too" drugs which do not offer any significant clinical improvement over existing drugs and therapies. Entry barriers protecting this group are fairly low for several reasons. First, entry into the basic chemical-processing field –generic drugs- is not considerably sensitive to scale effects (Bogner & Thomas, 1996). Second, there is no high uncertainty, asset specificity and sunk costs associated with developing R&D expertise. Third, due to the non-exclusive nature of such drugs, product differentiation is difficult to achieve for members of this group. Finally, razor-thin net margins resulting from inexistent product differentiation, combined with low levels of diversification, internationalization and network centrality places members of this group in the weakest competitive position particularly in front of any possible pricing predatory behavior. I operationalized firm strategic group membership using two dummy variables. The first group was designated as the reference group in the regression models.

The airline industry

The most important mobility barriers limiting competition in the international airline industry are related to the regulatory environment in which international airlines operate (O'Connor, 2001; Oum & Yu, 1998, Williams, 2002). Indeed, the right to enter an international market, that is, the right to operate a flight between a city in an airline's home country and another city in a foreign country, can be obtained only through negotiations between airline's own government and the government of the foreign country. These negotiations, often based on political rather than economic considerations, lead to "bilateral air service agreements" which not only designate airlines allowed to provide international service, but also determine routes to be operated between the two countries, capacity and frequency to be provided by each airline, and in some cases, even the type of equipment and departure times of each airline (O'Connor, 2001; Oum & Yu, 1998). Such restrictions, intended to protect government-owned flag carriers, often prohibit further entry to international markets, and in best cases, highly restrain the strategic choice domain of airlines.

I measured the level of protection awarded to each airline by its home country set of regulatory bilateral agreements along two dimensions: (1) designation restriction and (2) capacity restriction[8].

Designation is a term used in the international airline industry to indicate whether each party in the bilateral agreement is allowed to designate more than one air carrier to operate international routes linking the two countries (ICAO, 1995; O'Connor, 2001; Oum & Yu, 1998). Bilateral air service agreements which permit only one airline from each side to fly a particular international route -*single designation* agreements- are the most restrictive since they prohibit any further entry to the international market. On the other hand, agreements which allow each side to designate more than one airline to exercise the agreed operating rights -*multiple designation agreements*, are the least restrictive because they permit additional entry to the market. Between these two extreme cases, there exists an intermediate category of agreements which allows multiple designation but with route limitation. In this case, the agreement may stipulate that on a particular route, only one airline from each side may be designated. Hence, to obtain an index capturing the level of protection granted by each country to its carriers by means of the designation clause, I first coded all bilateral air service agreements in force in each year *t* using the following ordinal scale:

- Single designation agreements, the most restrictive category, were given a score of 1.

[8] To do so, I used data published by the ICAO in different editions of the "digest of bilateral air transport agreements".

- Multiple designation agreements which stipulated some restrictions on particular routes were given a score of 2.
- Multiple designation agreements without restrictions, the least restrictive category, were given a score of 3.

These scores were recorded and then averaged across all the bilateral agreements involving a particular country. In other words, for each air carrier *i*, I obtained a designation score, calculated as follows:

$$\text{Designation score} = \left(\sum_{j=1}^{k} D_j\right)/K$$

Where

- D_j designates the level of restriction stipulated by the bilateral air service agreement *j* signed by airline's *i* home country. D_j is equal to 1 if the agreement *j* includes a single designation clause; equal to 2 if the agreement *j* includes a multiple designation clause but with route restriction; and equal to 3 if the agreement *j* includes a multiple designation clause.
- K refers to the total number of the bilateral air service agreements signed by airline's *i* home country.

Hence, the lower the value of airline's *i* designation score, the higher the level of protection resulting from the designation clause stipulated in the set of bilateral air service agreements signed by airline's *i* home country.

The second important type of regulatory restrictions intended to protect flag carriers' international market share is related to the "*capacity clauses*" incorporated in most of the bilateral air service agreements (ICAO, 1995, O'Connor, 2001; Oum & Yu, 1998). Capacity refers to the total number of seats made available by an airline on a specific international route for a particular period. In bilateral air service agreements, there exist three major categories of capacity control systems: predetermination, Bermuda I and free-determination (ICAO, 1995). The so called "*predetermination*" of capacity system is the most restrictive capacity control regime because designated air carriers must receive governmental authorization before they may raise the capacity of their offerings in the international market (ICAO, 1995; O'Connor, 2001). Conversely, bilateral agreements adopting a *free-determination* of capacity schema are the least restrictive since designated airlines are allowed to adjust capacity, frequency and aircraft types used as they desire. The third type of arrangement, known as "*Bermuda I*", offers an intermediate level of regulatory restriction. Indeed, under this capacity control system a designated air carrier may alter capacity and frequency without prior authorization of the foreign government. However, the foreign government has the right to protest to the designated airline's government if it considers that such changes are unfair on one or more aspects (ICAO, 1995; O'Connor, 2001). Thus, to proxy the level of protection awarded by each country to its carriers through the capacity clause, I coded all bilateral air service agreements in force in each year *t* as follows:

- Predetermination agreements were given a score of 1.
- Bermuda I type agreements were given a score of 2.
- Free determination agreements were given a score of 3.

Next, for each air carrier *i*, I calculated a capacity score defined as follows:

$$\text{Capacity score} = \left(\sum_{j=1}^{k} C_j\right) / K$$

Where

- C_j denotes the degree of restriction set by the bilateral air service agreement j signed by airline's i home country. C_j is equal to 1 if the agreement j includes a predetermination of capacity clause; equal to 2 if the agreement j includes a Bermuda I type clause; and equal to 3 if the agreement j includes a free-determination of capacity clause.
- K refers to the total number of the bilateral air service agreements signed by airline's i home country.

Thus, the lower the value of airline's i capacity score, the greater the level of regulatory protection generated by the set of bilateral air service agreements signed by airline's i home country.

In addition, I included in the analysis seven other strategic scope and resource commitments variables reflecting the firm's product/market strategy, and therefore, how and where the airline competes. Airline's geographical scope, which represents an important strategic commitment in terms of fleet composition, purchase of associated equipment, and scheduling was measured using two variables: geographical regions covered and international focus. To calculate the first variable, I divided the globe up into seven regions (Africa, Australia, Asia, Europe, The Middle East, North America, and South America). Then, for each airline, I summed the total number of regions covered by the airline. Airline international focus was captured using the percentage of total international passenger-kilometre flown (scheduled + charter) relative to airline's total passenger kilometre flown (Domestic + International). Similarly, the degree to which an airline relies on charter operations was measured using the percentage of total international passenger-kilometre flown (scheduled + charter) relative to airline's total passenger kilometre flown (Domestic + International). In addition, airlines capacity was operationalized as airline's international available seat-kilometres. This measure is equal to the sum of the products obtained by multiplying the number of passenger seats available for sale on each flight by the flight distance. Airline's reliance on wide body jets was operationallized as the percentage of wide body jets relative to airline total fleet while airline's commitment to all-cargo flights was operationalized as the total all-cargo tonnes kilometres performed by the airline during the fiscal year. The last strategic variable captured the fleet size of the airline. It was defined as the total number of aircraft in service and available for operation, including aircrafts leased in from other organizations.

The results of the clustering procedure described above suggested the presence of four distinct strategic groups over the period 1996-2000. The main characteristics of each strategic as well as firm strategic group membership are presented in tables 3 and 4.

Table 3: Characteristics of strategic groups in the airline industry

Strategic variable	**Group 1**	**Group 2**	**Group 3**	**Group 4**
Designation score	Below average	Well above average	Average	Average
Capacity score	Below average	Well above average	Average	Average
Available seat-kilometres	Average	Above average	Below average	Well above average
Fleet	Average	Well above average	Below average	Average
Regions served	Above average	Average	Below average	Above average
International focus	Above average	Well below average	Below average	Above average
Charter commitment	Average	Below average	Above average	Below average
Wide body jet % of total fleet	Average	Below average	Below average	Above average
All cargo operations	Average	Average	Average	Well above average
Mobility barriers protecting the strategic group	**Very High**	**Moderate**	**Moderate**	**Moderate**

Table 4: Firm group membership in the airline industry over the period 1996-2000

Airline	Country	1996	1997	1998	1999	2000
Adria Airways	Slovenia	3	3	3	3	3
Aerlineas Argentinas	Argentina	1	1	1	1	1
Aeroflot Russian	Russia	1	1	1	1	1
Aeromexico	Mexico	3	3	3	3	3
Air Canada	Canada	1	1	1	1	1
Air Europa	Spain	3	3	3	3	3
Air France	France	4	4	4	4	4
Air India	India	1	1	1	1	1
Air Malta	Malta	3	3	3	3	3
Air Mauritius	Mauritius	1	1	1	1	1
Alaska Airlines	USA	3	3	2	2	2
Alitalia	Italy	1	1	1	1	1
All Nippon Airways	Japan	1	1	1	1	1
American Airlines	USA	2	2	2	2	2
American West Airlines	USA	3	3	2	2	2
Austrian Airlines	Austria	1	1	1	1	1
Avianca	Colombia	3	3	3	3	3
Bmi British Midland	UK	3	3	3	3	3
Braathens	Norway	3	3	3	3	3
British Airways	UK	4	2	4	4	4
Cathay Pacific	Hong Kong	4	4	4	4	4
Comair	South Africa	3	3	3	3	3
Continental	USA	2	2	2	2	2
Crossair	Switzerland	3	3	3	3	3
CSA	Czech	1	1	1	1	1
Cyprus Airways	Cyprus	1	1	1	1	1
Delta Airlines	USA	2	2	2	2	2
El Al	Israel	1	1	1	1	1
Emirates	UAE	1	1	1	1	1
Finnair	Finland	1	1	3	3	3
Garuda	Indonesia	1	1	1	1	1
Gulf Air	Bahrain	1	1	1	1	1
Iberia	Spain	1	1	1	1	1
Iceland Air	Iceland	3	3	3	3	3
Indian Airlines	India	3	3	3	3	3
Iran Air	Iran	3	3	3	3	3
Japan Air System	Japan	3	3	1	1	2
Japan Airlines	Japan	4	4	4	4	4
Kenya Airways	Kenya	1	1	1	1	1
KLM	Netherlands	4	1	1	1	1
Korean Airlines	Korea	4	4	4	4	4
Kuwait Airways	Kuwait	1	1	1	1	1

Airline	Country	1996	1997	1998	1999	2000
Lan Chile	Chile	3	3	1	1	1
Lauda Air	Austria	1	1	3	1	3
LOT	Poland	1	1	1	1	1
Lufthansa	Germany	4	4	4	4	4
Maersk Air	Denmark	3	3	3	3	3
Malaysia Airline System	Malaysia	1	1	1	1	1
Malev	Hungary	1	1	1	1	1
Meridiana	Italy	3	3	3	3	3
Mexicana	Mexico	3	3	3	3	3
Northwest Airlines	USA	2	2	2	2	2
Olympic Airways	Greece	1	1	1	1	1
Pakistan International	Pakistan	1	1	1	1	1
Philippine Airlines	Philippines	1	1	1	1	1
Qantas	Australia	1	1	1	1	1
Royal Air Maroc	Morocco	1	1	1	1	1
Royal Jordanian	Jordan	1	1	1	1	1
Saa South African Airways	South Africa	1	1	1	1	1
Sabena	Belgium	1	1	1	1	1
SAS	Denmark	1	1	1	1	1
Singapore Airlines	Singapore	4	4	4	4	4
Swissair	Switzerland	1	1	1	1	1
Tap Air Portugal	Portugal	1	1	1	1	1
Thai Airways	Thailand	1	1	1	1	1
Transavia	Netherlands	3	3	3	3	3
Transbrasil	Brazil	3	3	3	3	3
Tunisair	Tunisia	3	3	3	3	3
Turkish Airlines	Turkey	1	1	1	1	1
TWA	USA	2	2	2	2	2
United Airlines	USA	2	2	2	2	2
US Airways	USA	2	2	2	2	2
Varig	Brazil	1	1	1	1	1
Vasp	Brazil	1	1	1	1	3
Virgin Atlantic Airways	UK	1	1	1	1	1

In terms of the protection awarded to the air carriers by their home country set of regulatory bilateral agreements, the first group ranks at the top of the hierarchy in terms of mobility barriers surrounding groups. Indeed, the bilateral agreements signed by the home countries of members of this group generally permit only one airline from each country and limit the capacity to be provided by each airline. As a result, members of this group face limited competition in their international operations. Moreover, the threat of competition which may arise from potential firms outside the industry is very limited as entry to their market is blockaded by the regulatory agreements. Along the resource commitment variables, members of this group showed above average scores in terms of the number of geographical regions served and international focus and average scores in terms of the proportion of wide body jets, magnitude of all-cargo international operations, fleet size, charter commitment and capacity as measured by total available international seat-kilometres.

The other three strategic groups identified in the airline industry rank lower on the mobility barrier hierarchy in terms of the protection provided by the regulatory environment. Indeed, the second group consisted quasi-exclusively of US major airlines, which are protected by very low regulatory mobility barriers. Deregulation of the domestic market and high level of liberalization of international air services put strong downward pressure on fares and yields of these U.S. airlines (Oum & Yu, 1998). The third group comprised airlines displaying the highest commitment to charter activity, the lowest capacity, the smallest fleet in number and size and the most limited geographical scope. The level of protection offered to these airlines by the regulatory environment is moderate. Finally, the fourth group consisted of a small number of air carriers awarded only moderate levels of regulatory protection. Members of this group shows, on average, the highest scores of the industry in terms of the number of geographical regions served, proportion of wide body jets, magnitude of all-cargo international operations, international focus, and capacity as measured by total available international seat-kilometres. Hence, I operationalized firm strategic group membership using three dummy variables. Since we are interested in comparing the groups protected by low mobility barriers with the group surrounded by the highest mobility barriers, the latter was designated as the reference group.

The automotive industry

In the context of the automotive industry, I employed seven variables to assess the height of mobility barriers protecting the different strategic group present in this industry. These strategic variables captured the importance of size, technological expertise, labour costs advantage and supply chain superiority, which have been extensively documented in the automotive economics and strategic management literatures (Bhaskar, 1980; Bloomfield, 1978; Fine & Raff, 2001; Liker & Yu, 2000; Nohria & Garcia-pont, 1991; Garcia-pont & Nohria, 2002; Rhys, 1972; Wolters & Enders, 2001).

Since the early stages in the history of the automotive industry up to present, firm size continued to be the most fundamental factor shaping the structure of the industry. Indeed, productivity gains along the value chain generated by both economies of scales and learning effects are very significant in the automotive industry (Bloomfield, 1978; Nohria

& Garcia-pont, 1991; Wolters & Enders, 2001). In addition, important bargaining power obtained by large car manufacturers thanks to their huge purchase volume is often associated with considerable cost reductions (Bloomfield, 1978; Dawlatshahi, 1999). Furthermore, the average cost per vehicle of large automakers may be significantly reduced as research and development expenditures are distributed across a large number of vehicles (Wolters & Enders, 2001). Thus, to proxy firm's ability to exploit economies of scale in production activities I used three variables: firm's total assets and firm's total number of vehicles and commercial vehicles produced by the firm during the fiscal year (Nohria & Garcia-pont; 1991; Garcia-pont & Noria, 2002). To measure firm's technological expertise, I employed the cumulative number of patents issued by the USPTO to the firm over a 5 years period. Since the automotive industry is labour intensive (about 50% of total costs), country differences in terms of labour cost can have important competitive implications (Nohria & Garcia-pont; 1991). By transferring production to countries with low labor costs, considerable cost reductions can be realized (Wolters & Enders, 2001). This aspect is measured using the weighted average of firm production in different countries and the labour cost in each of those locations. In addition, I measured firm diversification using the sum of the number of industries in which the company competed, as indicated by four-digit SIC codes. Finally, I captured firm's superiority in supply chain management using the days to sell inventory ratio (Liker & Yu, 2000). This ratio was defined as the average of the most current two years of total inventories divided by the sum of cost of goods sold divided by 360. The lower the days to sell inventory ratio, the greater the supply chain performance of a car manufacturer (Liker & Yu, 2000). The results of the two-stage clustering procedure proposed by Ketchen & Shook (1996) revealed the presence of three strategic groups in the automotive industry over the period 1991-1997. The main characteristics of each strategic as well as firm strategic group membership are presented in tables 5 and 6.

Table 5: Characteristics of strategic groups in the automotive industry

Strategic variable	**Group 1**	**Group 2**	**Group 3**
Total assets	Well above average	Average	Average
Total vehicles produced	Well above average	Average	Average
Commercial vehicles produced	Well above average	Below average	Average
Labour cost index	Average	Above average	Below average
Patent stock	Well above average	Average	Average
Diversification	Average	Above average	Below average
Days to sell inventory	Below average	Above average	Below average
Mobility barriers protecting the strategic group	**Very High**	**Moderate**	**Moderate**

The strategic positioning of the first group along the economically important dimensions endowed its members with the highest mobility barriers of the industry. Indeed, members of this strategic group showed, on average, the highest scores of the industry in terms of total assets, total number of cars and commercial vehicles produced and patent stock. In addition, members of the first group had low levels of days to sell inventory and average labour cost index. These characteristics correspond to the most crucial factors affecting automobile operating costs (Fine & Raff, 2001; Nohria & Garcia-pont; 1991).

The two other strategic groups scored lower on the economically important dimensions identified in the automotive industry. Indeed, the second group was primarily composed of several mid-sized diversified European car manufacturers, who had above average scores on labour cost index and days to sell inventory. Finally, the third group was dominated by Japanese and Korean automobile producers. These firms were about the average size of the industry but had relatively low levels of labour cost index and days to sells inventory. Thus, I operationalized firm strategic group membership in the automotive industry using two dummy variables. The first strategic group surrounded by the highest mobility barriers was designated as the reference group.

Table 6: Firm group membership in the automotive industry over the period 1991-1997

Firm	1991	1992	1993	1994	1995	1996	1997
Audi	2	2	2	2	2	2	2
Bayerische Motoren Werke (BMW)	2	2	2	2	2	2	2
Chrysler Corporation	3	3	3	3	3	3	3
Daihatsu Motor Corporation	3	3	3	3	3	3	3
Daimler-Benz	2	2	2	2	2	2	2
Fiat	2	2	2	2	2	2	2
Ford Motor Company	1	1	1	1	1	1	1
Fuji Heavy Industries (Subaru)	2	2	2	2	3	2	2
General Motors Corporation	1	1	1	1	1	1	1
Honda Motor Corporation	3	3	3	3	3	3	3
Hyundai Motor Corporation	3	3	3	3	3	3	3
Isuzu Motors Corporation	2	2	2	2	2	2	2
Kia Motors Corporation	3	3	3	3	3	3	3
Mazda Motor Corporation	3	3	3	3	3	3	3
Mitsubishi Motors Corporation	3	3	3	3	3	3	3
Nissan Motor Corporation	1	1	2	2	2	2	2
Suzuki Motor Corporation	2	2	2	2	2	2	2
Toyota Motor Corporation	1	1	1	1	1	1	3
Volkswagen	3	3	2	2	2	2	2
Volvo	2	2	2	2	2	2	2

Within-group multimarket contact

The variable within-group multimarket contact is a group-level index capturing the extent to which members of a focal strategic group *G* compete against each other in multiple markets. To proxy this variable, I first calculated the weighted average number of multimarket contact each firm *i* belonging to strategic group *G* had with all other firms belonging to the same group *G*. To capture the importance of the market contact to each firm, I assigned a weighted value to contacts according to the degree of concentration in the contact market *m*. Hence, I defined

$$\text{Multimarket Contact with Group Insiders for firm } i \ (\text{MCGI}_i) = \frac{\displaystyle\sum_{\substack{j\neq i \\ j\in G_i}} \sum_{m=1}^{M} \frac{1}{D_m} (C_{im} \times C_{jm})}{N_i - 1}$$

Where

- m designates a given market segment in a set of potential segments M,
- C_{im} is a variable set equal to 1 if firm i sells products in segment m and to zero otherwise,
- C_{jm} is a variable set equal to 1 if firm j sells products in segment m and to zero otherwise,
- D_m is the total number of firms competing in market segment m,
- G_i is the strategic group to which firm i belongs and N_i is the size of this group.

Next, to obtain a group-level measure reflecting the extent to which members of a focal strategic group G meet with each other in multiple markets, the following index was computed:

For each strategic group G, *within-group multimarket contact* $= (\sum_{\substack{i=1 \\ i \in G}}^{Ni} MCGI_i)/N_i$

The market for ethical pharmaceutical products is usually segmented either by allocating drugs to therapeutic classes according to chemical action and therapeutic purpose (e.g. penicillin, diuretics) or by allocating drugs to disease groups according to their use (e.g. pneumonia, bronchitis, etc.). In this research, I used the classification scheme reported in the National Drug Code Directory, which is based of the AMA drug evaluations subscription. This classification identifies 159 market segments or "therapeutic classes". Hence, in the measures introduced above, C_{im} is an indicator variable set equal to one if firm i sells products in therapeutic class m and to zero otherwise. Similarly, C_{jm} is an indicator variable set equal to one if firm j sells products in therapeutic class m and to zero otherwise.

The automotive market can be segmented along several dimensions such as vehicle function or use, size, weight, method of propulsion, engine capacity and price. In this study, I used the categorization adopted by the Ward's Automotive Yearbook, which segments the market according to the marketing intent of manufacturers (Goldberg, 1995; Sudhir, 2001, Verboven, 1996). This classification identifies 23 distinct market segments: lower small, upper small, small specialty, lower middle, upper middle, middle specialty, large, large specialty, lower luxury, middle luxury, upper luxury, luxury specialty, luxury sport, small sport utility, middle sport utility, large sport utility, luxury sport utility, small van, middle van, large van, small pickup, large pickup and commercial chassis. Accordingly, in the context of the auto industry, C_{im} is an indicator variable set equal to one if firm *i* sells products in market segment m and to zero otherwise. Similarly, C_{jm} is an indicator variable set equal to one if firm *j* sells products in market segment *m* and to zero otherwise.

Within-group density of ties

Before computing the different network measures, I had to make a number of choices in constructing the adjacency matrices representing the ties between the firms. The first issue concerns the weights to be given to the different types of strategic alliances. Indeed, because different types of alliances vary in terms of resource commitment, management complexity, organizational interdependence, the ease with which they can be dissolved and the intensity of flow of information, assets, and knowledge, I had to decide how to weight each kind of alliance. In the context of the airline industry, I used the typology proposed by Rhoades and Lush (1997), which assigns weights to each alliance type based on partners commitment of resources and complexity of arrangements. This typology rates the strength of the alliance from 1 (weak) to 9 (strong). For instance, code sharing agreements, which require little commitment of resources and low complexity of arrangements, are given a score of 1. On the other hand, joint venture and equity ownership agreements, which require much more coordination of actions and higher interaction in terms of frequency and depth, are given a score of 9. The scale used for rating the strength of each type of alliance in the airline industry is shown in Table 7. Similarly, in the context of the pharmaceutical industry I assigned weights to each alliance type based on the intensity of the tie using Contractor and Lorange (1988) ordinal scale. The main features of this scale are presented in table 8.

Table 7: Weights given to each type of strategic alliance in the airline industry

Type of alliance	Strength	Score
Code sharing agreements	Weak	1
Insurance and parts pooling	↓	2
Facilities sharing, joint ground handling, maintenance		3
Block space/seat, wet lease, revenue sharing, franchising		4
Joint service	Moderate	5
Joint marketing, schedule coordination, frequent flyer plans	↓	6
Computer reservation systems		7
Management contracts		8
Joint venture and equity ownership	Strong	9

Table 8: Weights given to each type of strategic alliance in the pharmaceutical industry

Type of alliance	Strength	Score
Marketing and distribution agreements	Weak	1
Licensing agreements	↓	2
Manufacturing agreements		3
R&D agreements	Moderate	4
Minority ownership	↓	5
Joint venture		6
Majority ownership	Strong	7

The second issue concerns the treatment of cases where partners had different types of alliance agreements simultaneously. To ensure the robustness of my findings, I have performed two separate analyses using, in the first case, the score of the strongest alliance formed by partners and, in the second case, the sum of scores of all ties linking the two partners (Gulati, 1999; Madhavan, Koka & Prescott, 1998; Nohria & Dupont-Garcia, 1991). Findings obtained using the two distinct coding methods were very similar.

The density of ties among firms belonging to the same group describes the general level of linkages among group members (Scott, 2000). It is a recommended measure of group cohesion (Wasserman & Fraust, 1994). This group-level index is usually calculated as a ratio of the number of relationships that exist among members of a particular group, compared with the total number of possible relationships if all group members were all tied to each other (Rowley, 1997). Therefore, for each strategic group *G* in the industry and for each year t, the density of ties among group members (DT_t) is defined as follows (Scott, 2000):

$$DT_t = \sum_{\substack{i=1 \\ i \in G}}^{Ni} d_i \, / \, N_i \, (N_i - 1)$$

Where: N_i designates the size of the strategic group *G* to which firm *i* belongs.

d_i designates the weighted direct ties firm *i* has with other members of its strategic group.

Within-group role equivalence

Two organizations are role equivalent to the extent that their patterns of relationships with other organizations in the network are similar (Burt, 1991; Mizruchi, 1994). Thus, role equivalence is a pair-level measure of how similar the firms' network patterns of ties are (Gnyawali & Madhavan, 2001). Equivalence distance between a pair of firms is equal to zero when the two organizations have exactly the same pattern of relationships with other organizations in the network (Gulati & Gargiulo, 1999; Mizruchi, 1994). The two firms are decreasingly equivalent as equivalence distance increases (Burt, 1991; Wasserman & Fraust, 1994).

To obtain a pair-level index reflecting equivalence distance between a pair of firms, geodesic equivalence measures were computed. The geodesic equivalence measure focuses on similarity in the profiles of firm's geodesic[9] distances to other organizations in the network (Hanneman, 1999). Geodesic equivalence distances for each pair of firms *i* and *j* ($GED_{i,j}$) were obtained using the maxsim algorithm in the social network software UCINET. The *maxsim* algorithm starts with a distance matrix. Next, the distances of each firm are ranked from low to high, and the Euclidian distance is then employed to compute the dissimilarity between the distance profiles of each pair of firms (Hanneman, 1999).

For example, Table 9 presents the geodesic equivalence matrix generated by UCINET in the case of the network depicted in Figure 4. In this network, A and B, H and E, as well as C, D, F, G, I and J, are role equivalent because they have exactly the same patterns of relationships with other organizations. The geodesic equivalence matrix confirms this observation since zero geodesic equivalence distances separate these firms.

Table 9: Automorphic Equivalence Matrix using Maxsim

	A	B	C	D	E	F	G	H	I	J
A	0	0	8.01	8.01	6.67	8.01	8.01	6.67	8.01	8.01
B	0	0	8.01	8.01	6.67	8.01	8.01	6.67	8.01	8.01
C	8.01	8.01	0	0	5.65	0	0	5.65	0	0
D	8.01	8.01	0	0	5.65	0	0	5.65	0	0
E	6.67	6.67	5.65	5.65	0	5.65	5.65	0	5.65	5.65
F	8.01	8.01	0	0	5.65	0	0	5.65	0	0
G	8.01	8.01	0	0	5.65	0	0	5.65	0	0
H	6.67	6.67	5.65	5.65	0	5.65	5.65	0	5.65	5.65
I	8.01	8.01	0	0	5.65	0	0	5.65	0	0
J	8.01	8.01	0	0	5.65	0	0	5.65	0	0

[9] The shortest path between any particular pair of firms in a network (graph) is termed a geodesic (Scott, 2000).

At a strategic group level of analysis, all pairs of firms belonging to a focal strategic group *G* would be considered as role equivalent when all geodesic equivalence distances reported in the geodesic equivalence matrix are equal to zero. Pairs of firms forming the strategic group G are decreasingly equivalent as the values reported in the geodesic equivalence matrix increases. To obtain a group-level index, labelled Group Geodesic Equivalence Distance (GGED), reflecting the average geodesic equivalence distances among all pairs of firms belonging to the strategic group *G*, the following aggregate measure was computed:

For each year t, I calculated $GGED_t = [\sum_{i \in G, j \in G} GED_{ij} / N(N-1)]$

Where:

$GED_{i,j}$ designates the geodesic equivalence distances for each pair of firms *i* and *j* belonging to strategic group *G*

N designates the size of the strategic group *G* to which firms *i* and *j* belong.

The higher the value of the GGED index, the greater the average geodesic equivalence distance among pair of firms forming the strategic group G, and hence, the lower the role equivalence among group members. Since hypothesis 2 is expressed in terms of role *similarity* among group members, a more appropriate role equivalence index can be obtained by taking the negative of the GGED index. Therefore, I defined role equivalence (RE) among members of strategic group G as equal to $RE_G = - GGED_G$.

Within-group degree centrality heterogeneity

Degree centrality is a firm-level measure. It refers to the relative number of direct ties (degrees) a firm has with all other organizations in the network (Freeman, 1991). Therefore, for each focal firm *i* degree centrality (FDC_i) is defined as:

$FDC_i = d_i / N\text{-}1$

Where:

d_i designates the degree of firm *i* defined as the sum of its direct ties to other network members.

N designates the size of the network (graph), which is equal to the total number of firms in the sample. The sum of firm's *i* direct ties is divided by N-1 to standardize the degree centrality measure across networks having different sizes. For example, a firm with a degree of 25 in a network of 100 firms is not as central as a one with a degree of 25 in a network of 50. Therefore, the relative measure of degree centrality used in this study relates firm's degree to the maximum number the graph could sustain. A degree of 25 in a network of 100, hence, indicates a degree centrality equal to 25/(100-1) = 0.25 while a degree of 25 in a network of 50 firms indicates a degree centrality of 25/(50-1) = 0.51. Standardized in this way, degree centrality measures takes on values between 0 and 1, and can easily be compared to the other firms' indices, as well as across networks and relations (Wasserman & Fraust, 1994).

Next, to obtain a strategic-group level index reflecting the heterogeneity of group members in terms of degree centrality, I calculated, for each strategic group G, the variance in degrees centrality among group members (DCV_G) as follows:

$$DCV_G = [\sum_{i \in G} (FDC_i - \overline{FDC})^2] / N_G$$

Where:

FDC_i designates degree centrality for firm *i* belonging to strategic group *G*.

N_G designates the size of strategic group *G*.

$\overline{FDC}$ designates the mean degree centrality of the N_G firms belonging to strategic group *G*.

Finally, a group-level index capturing within-group degree centrality heterogeneity was obtained by computing the coefficient of variation of degrees centrality among group members. The coefficient of variation is defined as the ratio of the standard deviation to the mean (Chou, 1989). Hence, I defined within-group degree centrality heterogeneity (DCH) as follows:

For each strategic group G, $DCH_G = \sqrt{DCV}_G / \overline{FDC_G})$

Where:

$\overline{FDC_G}$ designates the mean degree centrality of the N_G firms belonging to strategic group *G*.

DCV_G designates the variance in degrees centrality among the members of the strategic group *G*.

The DCH index attains its minimum value of zero when all group members have the same degree centrality measures. The greater the value of the DCH index, the higher the heterogeneity of firms belonging to strategic group G in terms of degree centrality.

6.4 Control variables

In each of the three industries investigated, I controlled for several firm-specific characteristics which may influence firm economic performance. In the context of the pharmaceutical and automotive industries, I controlled for firm size, firm age and firm breadth of product scope. I measured firm size using total sales in dollars while firm age was operationalized as the chronological age of the company since its founding. Breadth of firm product scope was defined as the total number of market segments in which the firm competes. In the context of the airline industry, I controlled for two firm-specific characteristics, ownership status and firm age. I operationalized airline ownership status using a dummy variable coded 1 if the airline is public and 0 if it is state owned (Hanlon, 1999; O'Connor, 2001). An airline was considered state owned, if state government or one of its institutions, or the combination of both, controls 50 percent plus one of the airlines's voting stock.

In addition, I included in the analysis two other variables to control for the effect of inter-group competition on firm performance (Porter, 1979). The most relevant factors which may influence the degree and type of rivalry between strategic groups in an industry are strategic distance between groups and market interdependence among groups (Dranove et al., 1998; Porter, 1979). *Strategic distance between groups* refers to the extent to which strategic groups differ in terms of the key strategic decision variables for each year. Following Cool and Dierickx (1993), I used the sum of the Euclidian distances between the centroids of each pair of strategic groups to proxy strategic distance between groups for each year *t*. *Market interdependence among groups* denotes the degree to which different strategic groups in an industry are targeting the same customers rather than customers in distinctly different market segments. To proxy market interdependence among groups for each year *t*, I first calculated the average number of multimarket contact each firm *i* belonging to strategic group *G* had with all other firms not belonging to strategic group *G*. This measure was defined as follows:

$$\text{Multimarket Contact with Group Outsiders for firm } i \text{ (MCGO)} = \frac{\displaystyle\sum_{\substack{j \neq i \\ j \notin Gi}} \sum_{m=1}^{M} (C_{im} \times C_{jm})}{N - N_i}$$

Where

- m designates a given market segment in a set of potential segments M,
- C_{im} is a variable set equal to 1 if firm i sells products in segment m and to zero otherwise,
- C_{jm} is a variable set equal to 1 if firm j sells products in segment m and to zero otherwise,
- N equals sample size, G_i is the strategic group to which firm i belongs and N_i is the size of this group.

Next, to obtain an industry-level measure capturing the level of market interdependence among groups for each year *t* the following index was computed:

For each year t, market interdependence among groups = $(\sum_{i=1}^{N} MCGO_i) / N$.

Finally, I controlled for other environmental-level changes which might have influenced firm-level performance. Air travel demand is highly elastic with respect to average income level within the country in which the airline is established. For instance, in North America, high average GDP per capita translates into each person making at least two air trips per annum. At the other extreme of the income spectrum, only one in every hundred person takes an air trip per annum in countries like China and India (Hanlon, 1999). I operationalized average income level as the Gross Domestic Product (GDP) per capita in US dollars (1995 constant). Moreover, airlines are particularly sensitive to business cycles and other fluctuations in economic or political conditions (Hanlon, 1999; O'Connor, 2001). Therefore, in order to capture such effects, I added to our analysis two additional control variables. These variables are the annual change in the GDP and the annual change in the number of arrival of international tourists of the country in which the airline is established. Similarly, I controlled for environmental-level changes which might have influenced firm-level performance in both the pharmaceutical and the automotive industries using annual industry's revenues growth rate. Table 10, 11 and 12 present the correlations and descriptive statistics for all variables included in the analysis.

Table 10: Means, standard deviations and Pearson correlations– The automotive industry (1991-1997)

Variable	Mean (S.D)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1. Net income margin	0.79 (3.05)	1.00														
2. Total assets	48.23 (58.92)	0.05	1.00													
3. Total vehicles produced	1888.54 (1874.58)	0.18	0.89	1.00												
4. Commercial vehicles produced	543.94 (705.56)	0.17	0.86	0.89	1.00											
5. Labor cost index	18.01 (5.83)	0.21	0.00	-0.09	-0.10	1.00										
6. Patent stock	485.89 (556.95)	-0.05	0.76	0.76	0.70	-0.02	1.00									
7. Diversification	4.15 (0.91)	0.20	0.23	0.19	0.10	0.53	0.09	1.00								
8. Days inventory held	50.56 (25.18)	-0.02	-0.11	-0.25	-0.31	0.07	-0.15	0.27	1.00							
9. Total sales	42.18 (40.03)	0.10	0.96	0.93	0.84	0.07	0.81	0.29	-0.09	1.00						
10. Firm age	64.75 (22.94)	0.10	0.49	0.33	0.38	0.19	0.29	0.34	0.31	0.46	1.00					
11. Market segments	7.50 (6.04)	-0.03	0.75	0.78	0.81	-0.05	0.86	0.05	-0.33	0.78	0.17	1.00				
12. Strategic distance between groups*	2.48 (0.07)	0.26	0.08	0.15	0.14	0.13	-0.03	0.21	-0.04	0.09	0.08	0.00	1.00			
13. Industry annual growth rate*	1.48 (2.17)	0.07	0.05	0.11	0.10	0.17	-0.01	0.16	-0.03	0.07	0.05	0.02	0.53	1.00		
14. Market interdependence among groups*	1.31 (0.19)	0.01	0.77	0.79	0.75	-0.19	0.74	-0.09	-0.44	0.76	0.19	0.73	0.03	0.07	1.00	
15. Within-group multimarket contact*	0.33 (0.34)	0.02	0.82	0.82	0.79	-0.15	0.76	-0.01	-0.42	0.81	0.24	0.74	0.00	0.02	0.69	1.00

* Natural log transformation. Total panel (balanced) observations: 140 (7 years x 20 firms)

Due to the pooled nature of the sample, correlations tend to be overstated. Correlations greater than 0.14 are significant at $p< 0.05$.

Table 11: Means, standard deviations and Pearson correlations– The Airline industry (1996-2000)

Variable	Mean (S.D)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1. Load factor	68.30 (6.55)	1.00																	
2. Designation score	2.15 (0.53)	0.19	1.00																
3. Capacity score	1.50 (0.34)	0.31	0.61	1.00															
4. International available seat kilometer	25.11 (29.99)	0.42	0.26	0.30	1.00														
5. Fleet	100.62 (134.36)	0.32	0.45	0.62	0.63	1.00													
6. Regions served	4.35 (1.79)	0.41	-0.04	-0.06	0.52	0.26	1.00												
7. International focus	73.68 (29.46)	0.24	-0.37	-0.44	0.10	-0.42	0.34	1.00											
8. Charter commitment	9.42 (19.00)	0.05	-0.04	-0.06	-0.29	-0.24	-0.35	0.13	1.00										
9. Wide body jet % of fleet	33.44 (29.70)	0.24	-0.11	-0.17	0.34	-0.09	0.44	0.33	-0.38	1.00									
10. All cargo operations	0.33 (0.86)	0.27	0.01	0.03	0.57	0.18	0.28	0.19	-0.18	0.35	1.00								
11. Firm age	49.49 (18.36)	0.00	0.00	0.09	0.14	0.30	0.21	-0.16	-0.30	-0.17	-0.05	1.00							
12. Ownership status	0.41 (0.49)	-0.04	-0.31	-0.41	-0.19	-0.32	0.12	0.40	-0.10	0.16	-0.06	-0.02	1.00						
13. GDP per capita	17.30 (13.34)	0.36	0.34	0.62	0.33	0.40	0.07	-0.21	0.15	-0.06	0.19	-0.06	-0.46	1.00					
14. GDP change	3.24 (2.81)	0.15	0.06	0.04	0.00	0.05	-0.08	-0.03	0.03	-0.05	0.03	0.04	0.02	-0.06	1.00				
15. Change in international tourism	5.62 (12.00)	-0.09	0.01	-0.06	-0.03	-0.05	-0.03	-0.05	0.03	0.11	0.00	-0.01	0.00	-0.08	0.05	1.00			
16. Strategic distance between groups	26.16 (0.30)	-0.10	0.00	0.00	-0.04	-0.02	0.00	0.00	0.02	0.00	-0.02	-0.05	0.00	-0.01	-0.09	-0.07	1.00		
17. Within-group density of ties	0.71 (0.78)	0.31	0.17	0.15	0.68	0.35	0.40	0.11	-0.30	0.41	0.79	0.00	-0.10	0.27	0.02	-0.05	-0.04	1.00	
18. Within-group role equivalence	-15.20 (2.08)	-0.21	0.11	0.07	-0.23	-0.04	-0.38	-0.25	0.29	-0.32	-0.18	-0.12	-0.11	-0.01	0.12	0.03	0.33	-0.39	1.00
19. Within-group centrality heterogeneity	0.68 (0.20)	-0.36	-0.02	-0.09	-0.57	-0.35	-0.61	-0.24	0.47	-0.47	-0.46	-0.17	-0.05	-0.13	0.09	0.02	0.15	-0.65	0.60

Total panel (balanced) observations: 375 (5 years x 75 firms)

Due to the pooled nature of the sample, correlations tend to be overstated. Correlations greater than 0.14 are significant at $p < 0.05$.

Table 12: Means, standard deviations and Pearson correlations– The pharmaceutical industry (1997-2000)

Variable	Mean (S.D)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1. Price to book	7.18 (6.11)	1.00																			
2. Patent stock	99.85 (135.01)	0.19	1.00																		
3. Therapeutic innovation	0.50 (1.08)	0.26	0.56	1.00																	
4. Radical innovation	0.93 (1.52)	0.18	0.62	0.74	1.00																
5. Network centrality	0.73 (0.23)	0.29	0.35	0.23	0.20	1.00															
6. Diversification	3.18 (1.62)	-0.06	0.47	0.29	0.49	0.08	1.00														
7. Internationalization	39.91 (29.78)	0.02	0.22	0.21	0.31	0.08	0.37	1.00													
8. R&D intensity	16.16 (15.75)	0.15	-0.09	-0.07	-0.13	0.21	-0.23	-0.08	1.00												
9. Total Assets	7.53 (10.81)	0.11	0.80	0.57	0.64	0.29	0.52	0.31	-0.19	1.00											
10. Number of drugs marketed	30.64 (39.55)	0.10	0.34	0.30	0.44	0.06	0.27	0.16	-0.25	0.42	1.00										
11. Routes of administration offered	3.81 (2.75)	0.14	0.38	0.38	0.53	-0.01	0.35	0.26	-0.31	0.46	0.75	1.00									
12. Total Sales*	7.10 (2.14)	0.21	0.69	0.47	0.59	0.32	0.66	0.41	-0.33	0.75	0.43	0.55	1.00								
13. Age*	3.67 (0.93)	-0.03	0.46	0.38	0.42	0.03	0.58	0.28	-0.37	0.53	0.31	0.41	0.68	1.00							
14. Number of therapeutic classes*	2.91 (1.23)	0.02	0.23	0.27	0.42	-0.16	0.18	0.28	-0.38	0.34	0.69	0.73	0.33	0.30	1.00						
15. Strategic distance between groups*	2.48 (0.24)	0.04	0.04	0.00	-0.07	0.07	0.00	0.01	0.00	0.05	0.02	0.03	0.05	0.03	0.02	1.00					
16. Industry annual growth rate*	2.48 (0.24)	0.06	0.06	0.02	0.01	0.13	0.00	0.03	-0.06	0.03	0.01	0.01	0.03	0.02	0.02	-0.56	1.00				
17. Market interdependence among groups	9.61 (3.46)	-0.05	0.43	0.39	0.50	0.00	0.51	0.28	-0.63	0.52	0.46	0.56	0.59	0.58	0.57	0.29	-0.06	1.00			
18. Within-group multimarket contact*	-1.16 (1.33)	-0.07	0.44	0.41	0.55	-0.04	0.54	0.29	-0.65	0.53	0.48	0.58	0.61	0.60	0.59	0.05	-0.03	0.69	1.00		
19. Within-group density of ties*	0.25 (0.20)	0.23	0.68	0.61	0.74	0.27	0.51	0.31	-0.21	0.74	0.53	0.59	0.63	0.45	0.45	0.14	0.12	0.66	0.63	1.00	
20. Within-group role equivalence*	-2.69 (0.19)	-0.34	-0.39	-0.33	-0.35	-0.40	-0.07	-0.06	-0.47	-0.36	-0.15	-0.11	-0.15	0.08	0.06	-0.25	-0.12	0.16	0.26	-0.52	1.00
21. Within-group centrality heterogeneity*	-0.36 (0.29)	-0.26	-0.68	-0.62	-0.80	-0.27	-0.51	-0.31	0.12	-0.73	-0.51	-0.56	-0.63	-0.42	-0.41	-0.04	-0.02	-0.55	-0.57	-0.90	0.55

* Natural log transformation. Total panel (balanced) observations: 272 (4 years x 68 firms)
Due to the pooled nature of the sample, correlations tend to be overstated. Correlations greater than 0.14 are significant at $p < 0.05$.

7. RESULTS

In testing the research hypotheses across the three industries and over time, I used pooled time series cross-sectional regressions (Greene, 1993; Sayrs, 1989). Given that the data relates to a number of firms i (i=1,2, …n), over a number of years t (t=1,2,…k), I employed generalized least squares cross-sectional time series analysis, corrected for any latent heteroskedasticity and serial autocorrelation (Fuller & Battese, 1974; Greene, 1993; SAS Institute, 2000). Accordingly, regression models were estimated for the pharmaceutical industry with a cross sectional-time series sample of 272 observations (4 years x 68 firms), for the airline industry using a cross sectional-time series sample of 375 observations (5 years x 75 firms) and for the automotive industry with a cross sectional-time series sample of 140 observations (7 years x 20 firms).

The moderating impact of within-group multimarket contact

Hypothesis 1 suggests that within-group multi-market contact moderates the relationship between strategic group membership and performance. This hypothesis was tested using two samples from the automotive and pharmaceutical industries. For each of these industries, I estimated four different regression models. Model 1 includes only control variables. In Model 2, dummy variables representing firm strategic group membership were added to the regression, followed by the variable within-group multimarket in model 3. Finally, interaction effects were detected by adding to the regression the product of group dummy variables and within-group multimarket contact (Model 4). The results of the estimations for these models, illustrated in tables 13 and 14, provide support for hypothesis 1 in both the automotive and the pharmaceutical and industries.

Table 13: The moderating effect of within-group multimarket contact in the automotive industry - GLS hierarchical regression results (N=140)

Dependent variable	Net Income Margin			
	Model 1	Model 2	Model 3	Model 4
Total sales	0.04^{**} (0.01)	0.05^{**} (0.02)	0.04^{*} (0.02)	0.02 (0.02)
Firm age	-0.01 (0.02)	-0.01 (0.02)	-0.01 (0.02)	0.01 (0.02)
Market segments	-0.22^{*} (0.10)	-0.25^{**} (0.10)	-0.23^{*} (0.10)	-0.14 (0.10)
Industry annual growth rate^{+}	-0.14 (0.13)	-0.17 (0.13)	-0.20 (0.14)	-0.28^{*} (0.14)
Strategic distance between groups^{+}	11.94^{**} (4.05)	10.06^{*} (4.34)	8.75^{*} (4.52)	8.57 (5.52)
Market interdependence among groups^{+}	-0.19 (2.57)	3.97 (6.05)	2.70 (6.16)	9.17 (7.73)
Dummy variable 1 (refers to the second group)		3.00 (3.49)	8.10 (5.72)	28.98^{**} (8.71)
Dummy variable 2 (refers to the third group)		3.22 (2.79)	7.35 (4.63)	19.74^{**} (6.17)
Within-groups multimarket contact^{+}			6.37 (5.67)	14.04^{*} (6.05)
Dummy variable 1 x Within-group multimarket contact^{+}				-97.20^{**} (33.58)
Dummy variable 2 x Within- group multimarket contact^{+}				-16.91 (12.43)
R-Squared (percent)	13.33	14.91	15.42	22.63

Unstandardized coefficients are provided with standard errors in parentheses.

Significance levels: * $p<0.05$; ** $p<0.01$.

+: Natural Log transformation

The first group, which is protected by the highest mobility barriers, was designated as the reference group.

Table 14: The moderating effect of within-group multimarket contact in the pharmaceutical industry - GLS hierarchical regression results (N=272)

Dependent variable	**Price to book**			
	Model 1	Model 2	Model 3	Model 4
Total sales+	1.28^{**} (0.35)	0.99^{**} (0.37)	0.99^{**} (0.37)	1.00^{**} (0.37)
Firm age+	-1.32 (0.84)	-1.38 (0.82)	-1.38 (0.82)	-1.44 (0.82)
Number of therapeutic classes+	0.45 (0.50)	0.25 (0.50)	0.24 (0.50)	0.28 (0.50)
Strategic distance between groups+	20.69^{**} (5.97)	42.41^{**} (11.63)	48.51^{**} (18.23)	90.93^{**} (25.80)
Market interdependence among groups	-0.54^{**} (0.15)	-1.68^{**} (0.61)	-1.97^{*} (0.90)	-5.45^{**} (1.71)
Industry annual growth rate+	3.60^{**} (1.25)	6.02^{**} (1.65)	6.67^{**} (2.22)	15.52^{**} (4.37)
Dummy variable 1 (refers to the second group)		-13.89^{*} (6.26)	-12.36 (7.18)	-4.50 (8.09)
Dummy variable 2 (refers to the third group)		-6.18^{**} (2.23)	-5.68^{*} (2.52)	-28.02^{**} (9.83)
Within-group multimarket contact+			1.10 (2.52)	21.28^{*} (10.73)
Dummy variable 1 x Within-group multimarket contact+				-10.36 (8.60)
Dummy variable 2 x Within- group multimarket contact+				-39.51^{*} (17.72)
R-Squared (percent)	10.30	13.04	13.11	14.95

Unstandardized coefficients are provided with standard errors in parentheses.

Significance levels: * $p<0.05$; ** $p<0.01$.

+: Natural Log transformation

The first group, which is protected by the highest mobility barriers, was designated as the reference group.

The inclusion of the interaction terms in models 4 increased the R-squared from 15.4% to 22.6% % and from 13.1% to 14.9% for the automotive and pharmaceutical industries respectively. Hierarchical F tests evaluating the significance of the interaction effects (model 4 vs. model 3) were significant at the .05 level in both industries (Jaccard et al, 1990; Hardy, 1993). Moreover, in each model one interaction term was statistically different from zero at the 5% confidence. These results suggest that the strengths of the relationships between within-group multimarket contact and firm performance are not equivalent in the three strategic groups, with each group having a separate intercept and slope. In both the pharmaceutical and the automotive industries, the strategic group protected by the highest mobility barriers was designated as the reference group. Therefore, regression coefficients for the two interaction terms represent the differences between the within-group multimarket contact slope for the group protected by the highest mobility barriers and that for the two other groups ranking lower on the mobility barrier hierarchy (Cohen, Cohen, West & Aiken, 2003). Slopes of firm performance on within-group multimarket contact corresponding to each of the three groups in the pharmaceutical and the automotive industries are shown in figures 7 and 8. Examination of these regression slopes suggests that firm performance, as measured by price to book in the pharmaceutical industry, is significantly and positively related to the level of within-group multimarket contact for the big league group, the one protected by the highest mobility barriers. While the positive relationship holds for the group consisting of biopharmaceutical firms, its magnitude is weaker than for the big league group. In contrast, within-group multimarket contact among generic drug manufacturers is significantly and negatively associated with firm performance. Thus, the performance gains resulting from one unit increase in within-group multimarket contact are highest for members of the big league group (figure 7). Conversely, each unit increase in within-group multimarket contact results in performance reduction for members of the third group, the one surrounded by the lowest mobility barriers. Thus, all else being equal, the higher the level of multimarket contact within the strategic group protected by the highest mobility barrier, the greater the likelihood of finding significant performance differences across strategic groups. Similar results are found in the automotive industry. Indeed, figure 8 shows that net income margin is significantly and positively related to the level of within-group multimarket contact for the first group, the one protected by the highest mobility barriers. In contrast, the relationship between within-group multimarket contact and performance is negative for the second group and non-significant for the third group.

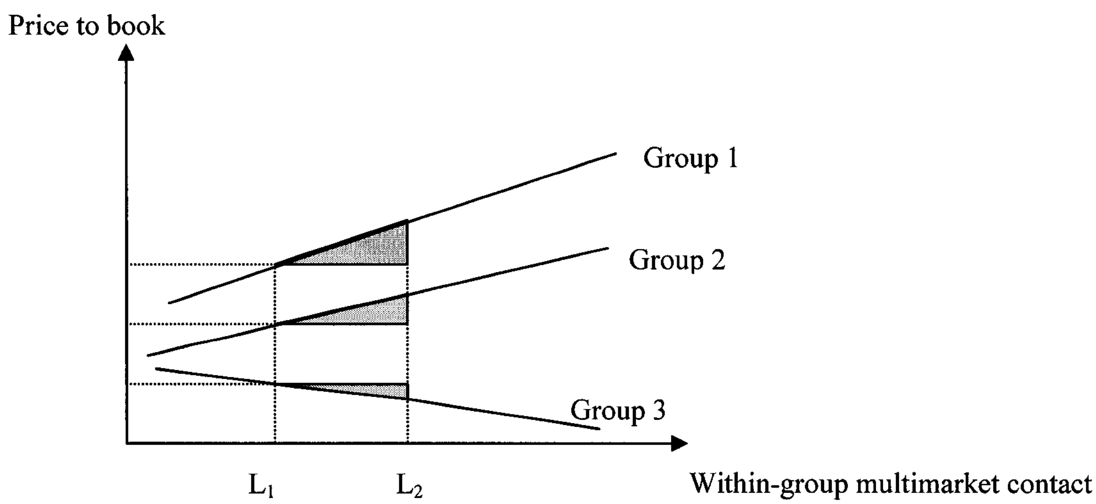

Figure 7: Slopes of price to book on within-group multimarket contact for the three strategic groups in the pharmaceutical industry

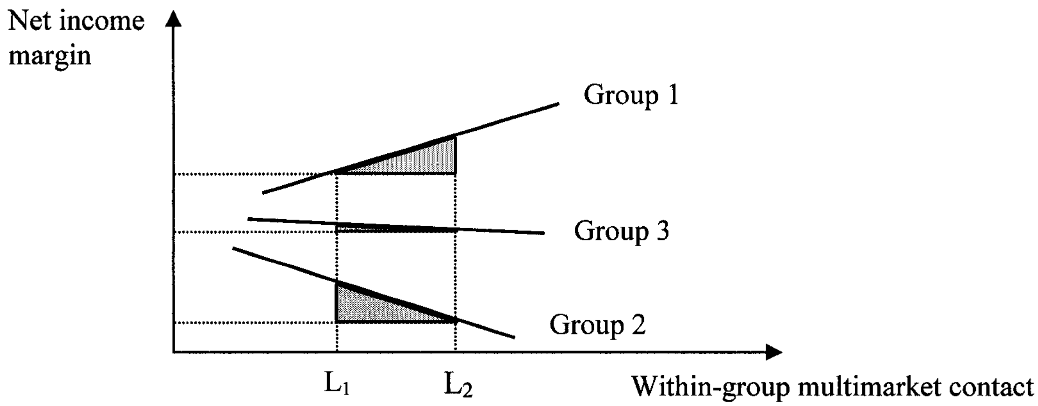

Figure 8: Slopes of net income margin on within-group multimarket contact for the three strategic groups in the automotive industry

The moderating impact of within-group density of ties

Hypothesis 2 suggests that within-group density of ties moderates the relationship between strategic group membership and performance. This hypothesis was tested using two samples from the airline and pharmaceutical industries. For each of these two industries, I estimated four different regression models. The first model includes only control variables. The second model adds to the first model a set of dummy variables capturing firm strategic group membership. In the third model, the variable within-group density of ties was entered. Finally, moderating effects were investigated by entering the product of group dummy variables and within-group density of ties (Model 4). The results of the estimations for the different models illustrated in tables 15 and 16 reveal that hypothesis 2 is supported in the airline industry but not in the pharmaceutical industry.

Table 15: The moderating effect of within-group density of ties in the airline industry - GLS hierarchical regression results (N=375)

Dependent variable	**Load factor**			
	Model 1	Model 2	Model 3	Model 4
Firm age	-0.02 (0.03)	-0.02 (0.03)	-0.02 (0.03)	-0.02 (0.03)
Ownership status	1.82 (1.28)	1.63 (1.26)	1.64 (1.26)	1.80 (1.25)
GDP per capita	0.13** (0.04)	0.13** (0.04)	0.13** (0.04)	0.14** (0.04)
GDP growth	0.21** (0.05)	0.22** (0.05)	0.22** (0.05)	0.22** (0.05)
International tourism growth rate	0.02 (0.01)	0.02 (0.01)	0.02 (0.01)	0.02 (0.01)
Strategic distance between groups	-1.59 (1.00)	-1.58 (1.01)	-1.61 (1.07)	-0.44 (0.87)
Dummy variable 1 (refers to the second group)		-0.45 (1.14)	-0.27 (1.16)	5.16** (2.18)
Dummy variable 2 (refers to the third group)		-0.86 (0.76)	-1.04 (0.78)	5.92** (1.61)
Dummy variable 3 (refers to the fourth group)		0.98 (1.39)	1.78 (1.64)	8.68** (2.30)
Within-groups density of ties			-0.40 (0.43)	11.50** (2.74)
Dummy variable 1 x Within-group density of ties				-10.49** (2.83)
Dummy variable 2 x Within-group density of ties				-14.20** (4.25)
Dummy variable 3 x Within-group density of ties				-12.08** (2.76)
R-Squared (percent)	9.27	9.90	10.03	16.06

Unstandardized coefficients are provided with standard errors in parentheses.

Significance levels: * $p<0.05$; ** $p<0.01$.

The first group, which is protected by the highest mobility barriers, was designated as the reference group.

Table 16: The moderating effect of within-group density of ties in the pharmaceutical industry - GLS hierarchical regression results (N=272)

Dependent variable	Price to book			
	Model 1	Model 2	Model 3	Model 4
Total sales	0.01 (0.01)	0.01 (0.01)	0.01 (0.01)	0.01 (0.01)
Firm age+	-0.10 (0.77)	-0.38 (0.76)	-0.40 (0.76)	-0.43 (0.76)
Number of therapeutic classes+	0.49 (0.52)	0.28 (0.52)	0.28 (0.52)	0.32 (0.51)
Strategic distance between groups+	17.81** (5.54)	29.47** (7.79)	31.85** (9.08)	44.55** (12.06)
Market interdependence among groups+	-3.11** (0.93)	-9.95** (4.11)	-9.67* (4.15)	-2.59 (6.12)
Industry annual growth rate+	3.37** (1.23)	4.31** (1.29)	4.90** (1.73)	8.22** (2.74)
Dummy variable 1 (refers to the second group)		-12.78* (6.16)	-13.35* (6.27)	-7.66 (7.24)
Dummy variable 2 (refers to the third group)		-4.54** (1.71)	-5.40* (2.40)	-3.37 (3.04)
Within-group density of ties+			-2.34 (4.56)	-9.65 (6.84)
Dummy variable 1 x Within-group density of ties+				12.24 (11.70)
Dummy variable 2 x Within- group density of ties+				-21.63 (14.17)
R-Squared (percent)	7.79	10.22	10.31	11.20

Unstandardized coefficients are provided with standard errors in parentheses.

Significance levels: * $p<0.05$; ** $p<0.01$.

+: Natural Log transformation

The first group, which is protected by the highest mobility barriers, was designated as the reference group.

In the context of the airline industry, the inclusion of the interaction terms increased the R-squared from 10.0% to 16.0%. The hierarchical F tests evaluating the significance of the interaction effects (model 4 vs. model 3) was significant at the .01 level (Jaccard et al, 1990; Hardy, 1993). Furthermore, both interaction terms were statistically different from zero at the 1% confidence level, with the theoretically expected signs. These findings suggest the presence of a strong interaction effect for the airline industry. Slopes of passenger load factor on within-group density of ties corresponding to each of the four strategic groups present in the airline industry are shown in figure 9. This figure shows that each unit increase in within-group density of ties among members of the first group, the one protected by the highest mobility barriers, generates significant performance gains, whereas these gains are non significant for other groups protected by lower mobility barriers.

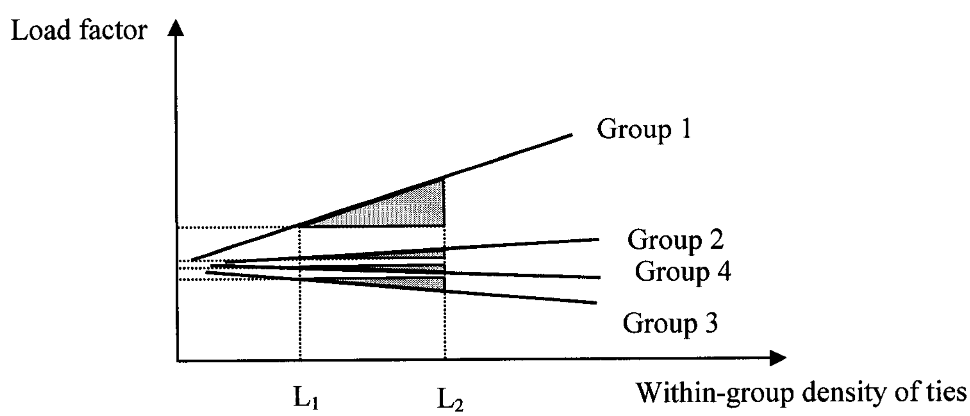

Figure 9: Slopes of load factor on within-group density of ties for the four strategic groups in the airline industry

Hypothesis 2 was not supported in the pharmaceutical industry. The addition of the interaction terms did not significantly improve the R-squared and both interaction terms were not statistically significant. Slopes of price to book on within-group density of ties corresponding to each of the three strategic groups present in the pharmaceutical industry are shown in figure 10. This figure suggests that the relationship between within-group density of ties and firm performance is not significant for all three strategic groups.

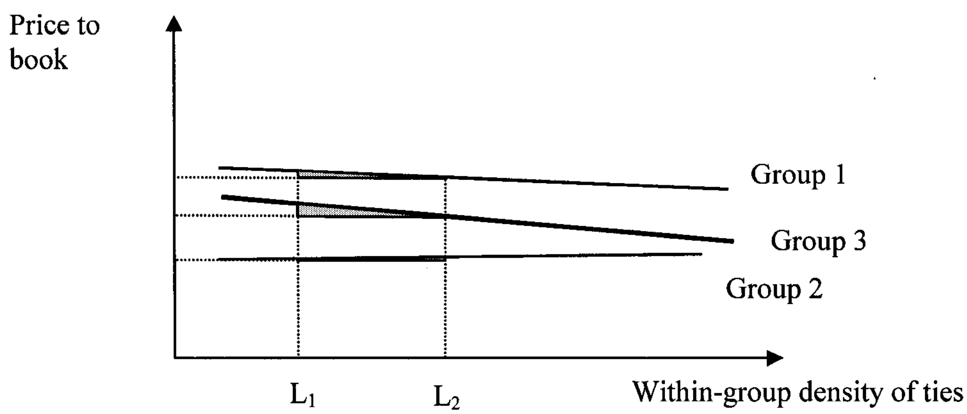

Figure 10: Slopes of price to book on within-group density of ties for the three strategic groups in the pharmaceutical industry

The moderating impact of within-group role equivalence

Hypothesis 3 suggests that within-group role equivalence moderates the relationship between strategic group membership and firm performance. This hypothesis was tested using two samples from the airline and pharmaceutical industries. Following the same hierarchical procedure described above, I estimated four different regression models for each of the two industries. The results of the estimations, showed in tables 17 and 18, suggest that hypothesis 3 is supported in both the airline and pharmaceutical industries.

Table 17: The moderating effect of within-group role equivalence in the pharmaceutical industry - GLS hierarchical regressions (N=272)

Dependent variable	**Price to book**$^{+}$			
	Model 1	Model 2	Model 3	Model 4
Total sales	0.01 (0.01)	0.01 (0.01)	0.01 (0.01)	0.01 (0.01)
Firm age^{+}	-0.03 (0.08)	-0.06 (0.08)	-0.06 (0.08)	-0.08 (0.08)
Number of therapeutic classes^{+}	0.03 (0.05)	0.02 (0.05)	0.03 (0.05)	0.02 (0.05)
Strategic distance between groups^{+}	1.87** (0.45)	2.72** (0.63)	5.33** (2.22)	7.02** (2.57)
Market interdependence among groups^{+}	-0.20** (0.08)	-0.74* (0.33)	-0.39 (0.44)	0.93 (0.62)
Industry annual growth rate^{+}	0.34** (0.10)	0.40** (0.10)	0.89* (0.41)	1.38** (0.48)
Dummy variable 1 (refers to the second group)		-0.95* (0.50)	-0.35 (0.70)	-10.26** (3.47)
Dummy variable 2 (refers to the third group)		-0.30* (0.15)	-0.70* (0.36)	-4.67* (2.11)
Within-group role equivalence^{+}			1.54 (1.26)	4.66** (1.84)
Dummy variable 1 x Within-group role equivalence^{+}				-4.15** (1.42)
Dummy variable 2 x Within- group role equivalence^{+}				-1.32* (0.68)
R-Squared (percent)	9.01	10.54	11.05	14.02

Unstandardized coefficients are provided with standard errors in parentheses.

Significance levels: * $p<0.05$; ** $p<0.01$.

+: Natural Log transformation

The first group, which is protected by the highest mobility barriers, was designated as the reference group.

Table 18: The moderating effect of within-group role equivalence in the airline industry - GLS hierarchical regression results (N=375)

Dependent variable	Load factor			
	Model 1	Model 2	Model 3	Model 4
Firm age	-0.02 (0.03)	-0.02 (0.03)	-0.02 (0.03)	-0.03 (0.03)
Ownership status	1.82 (1.28)	1.63 (1.26)	1.59 (1.26)	1.63 (1.25)
GDP per capita	0.13^{**} (0.04)	0.13^{**} (0.04)	0.13^{**} (0.04)	0.13^{**} (0.04)
GDP growth	0.21^{**} (0.05)	0.22^{**} (0.05)	0.22^{**} (0.05)	0.22^{**} (0.05)
International tourism growth rate	0.02 (0.01)	0.02 (0.01)	0.02 (0.01)	0.02 (0.01)
Strategic distance between groups	-1.59 (1.00)	-1.58 (1.01)	-1.46 (1.02)	0.28 (1.12)
Dummy variable 1 (refers to the second group)		-0.45 (1.14)	-0.47 (1.14)	9.59^{**} (3.41)
Dummy variable 2 (refers to the third group)		-0.86 (0.76)	-0.74 (0.78)	10.54^{**} (2.92)
Dummy variable 3 (refers to the fourth group)		0.98 (1.39)	0.86 (1.40)	23.21^{**} (5.39)
Within-group role equivalence			0.05 (0.08)	0.96^{**} (0.22)
Dummy variable 1 x Within-group role equivalence				-0.59^{**} (0.2)
Dummy variable 2 x Within-group role equivalence				-0.68^{**} (0.19)
Dummy variable 3 x Within-group role equivalence				-1.37^{**} (0.32)
R-Squared (percent)	9.27	9.90	10.01	15.03

Unstandardized coefficients are provided with standard errors in parentheses.

Significance levels: $^{*}p<0.05$; $^{**}p<0.01$.

The first group, which is protected by the highest mobility barriers, was designated as the reference group.

The addition of the interaction terms resulted in an increase of the R-squared from 11.0% to 14.0% and from 10.0% to 15.0% percent for pharmaceutical and the airline industries respectively. The associated hierarchical F tests evaluating the significance of the interaction effects (model 4 vs. model 3) were both significant at the .05 level (Jaccard et al, 1990; Hardy, 1993). Furthermore, all interaction terms were statistically different from zero at the 5% confidence. These findings suggest that the strengths of the relationships between within-group role equivalence and firm performance are not equivalent in all strategic groups. Slopes of firm performance on within-group density of ties corresponding to each strategic group in the pharmaceutical and the airline industries are shown in figures 11 and 12. Both of these two figures suggest that each unit increase in within-group role equivalence among members of the group surrounded by the highest mobility barriers yields significant performance gains. In contrast, performance gains are much lower for other groups protected by less significant mobility barriers.

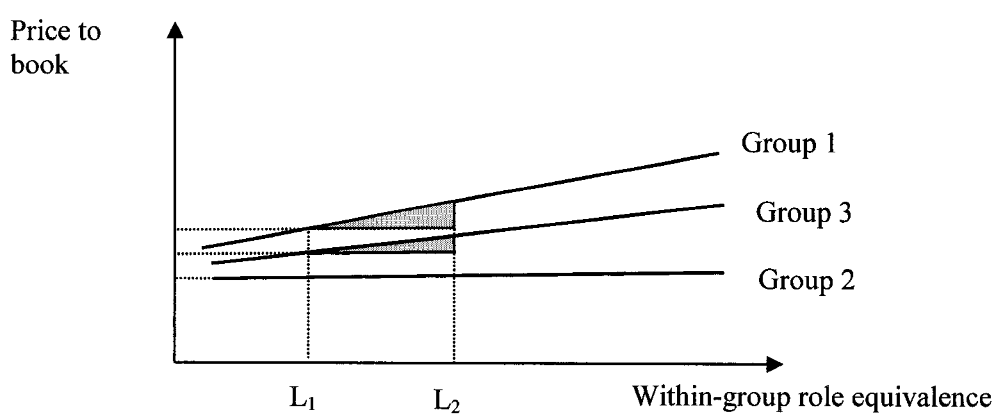

Figure 11: Slopes of price to book on within-group role equivalence for the three strategic groups in the pharmaceutical industry

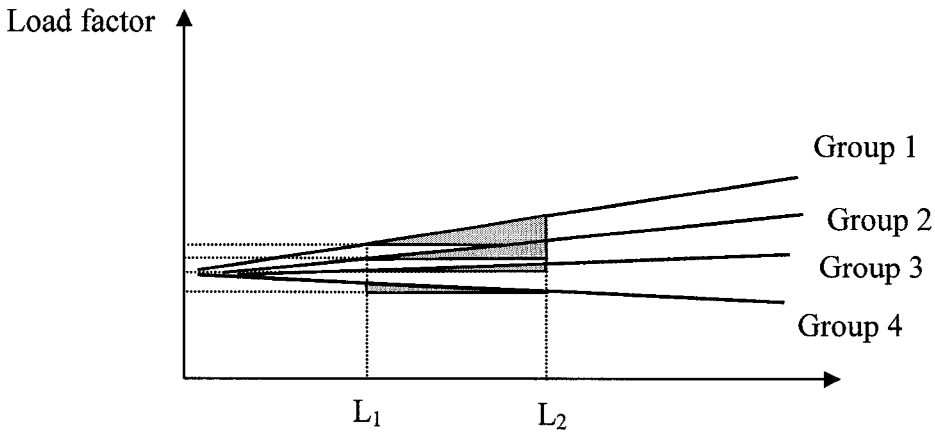

Figure 12: Slopes of load factor on within-group role equivalence for the four strategic groups in the airline industry

The moderating impact of within-group centrality heterogeneity

Hypothesis 4 suggests that within-group heterogeneity in terms of degree centrality moderates the relationship between strategic group membership and firm performance. This hypothesis, tested using two samples from the airline and pharmaceutical industries, was supported in both industries. Indeed, the inclusion of the interaction terms increased the R-squared from 15.7% to 17.6% % and from 10.1% to 19.5 percent for the pharmaceutical and the airline industries respectively. Both hierarchical F tests evaluating the significance of the interaction effects (model 4 vs. model 3) were significant at the .05 level (Jaccard et al, 1990; Hardy, 1993). Moreover, all interaction terms were statistically different from zero at the 5% confidence. These findings suggest the presence of a significant moderation effects in these two industries. The results of the estimations for these models are shown in table 19 and 20. In addition, slopes of firm performance on within-group heterogeneity in terms of degree centrality corresponding to each strategic group in the pharmaceutical and the airline industries are provided in figures 13 and 14.

Table 19: The moderating effect of within-group centrality heterogeneity in the airline industry - GLS hierarchical regression results (N=375)

Dependent variable	Load factor			
	Model 1	Model 2	Model 3	Model 4
Firm age	-0.02 (0.03)	-0.02 (0.03)	-0.02 (0.03)	-0.02 (0.03)
Ownership status	1.82 (1.28)	1.63 (1.26)	1.65 (1.26)	1.86 (1.24)
GDP per capita	0.13** (0.04)	0.13** (0.04)	0.14** (0.04)	0.14** (0.04)
GDP growth	0.21** (0.05)	0.22** (0.05)	0.22** (0.05)	0.22** (0.05)
International tourism growth rate	0.02 (0.01)	0.02 (0.01)	0.02 (0.01)	0.02 (0.01)
Strategic distance between groups	-1.59 (1.00)	-1.58 (1.01)	-1.73 (1.01)	0.01 (0.59)
Dummy variable 1 (refers to the second group)		-0.45 (1.14)	-0.28 (1.15)	-54.48** (11.44)
Dummy variable 2 (refers to the third group)		-0.86 (0.76)	-1.40 (0.90)	-49.66** (8.29)
Dummy variable 3 (refers to the fourth group)		0.98 (1.39)	1.36 (1.43)	-45.81** (8.47)
Within-group centrality heterogeneity			1.63 (1.47)	-80.13** (13.65)
Dummy variable 1 x Within-group centrality heterogeneity				88.43** (19.22)
Dummy variable 2 x Within-group centrality heterogeneity				79.00** (13.35)
Dummy variable 3 x Within-group centrality heterogeneity				72.58** (13.60)
R-Squared (percent)	9.27	9.90	10.19	19.54

Unstandardized coefficients are provided with standard errors in parentheses.

Significance levels: * $p<0.05$; ** $p<0.01$.

The first group, which is protected by the highest mobility barriers, was designated as the reference group.

Table 20: The moderating effect of within-group centrality heterogeneity in the pharmaceutical industry - GLS hierarchical regressions (N=272)

Dependent variable	**Price to book^{+}**			
	Model 1	Model 2	Model 3	Model 4
Total sales^{+}	0.16** (0.03)	0.15** (0.04)	0.15** (0.04)	0.15** (0.04)
Firm age^{+}	-0.20** (0.08)	-0.21** (0.08)	-0.22** (0.08)	-0.22** (0.08)
Number of therapeutic classes^{+}	0.02 (0.05)	0.01 (0.05)	0.01 (0.05)	0.02 (0.05)
Strategic distance between groups^{+}	1.73** (0.45)	2.44** (0.63)	2.35** (0.65)	4.50** (1.08)
Market interdependence among groups^{+}	-0.24** (0.08)	-0.71* (0.33)	-0.75* (0.34)	-0.50 (0.35)
Industry annual growth rate^{+}	0.29** (0.10)	0.34** (0.11)	0.32** (0.11)	0.39** (0.11)
Dummy variable 1 (refers to the second group)		-0.79 (0.50)	-0.70 (0.52)	2.20 (1.26)
Dummy variable 2 (refers to the third group)		-0.21 (0.14)	-0.06 (0.26)	3.07** (1.26)
Within-group centrality heterogeneity^{+}			-0.25 (0.35)	-3.33** (1.27)
Dummy variable 1 x Within-group centrality heterogeneity^{+}				2.44* (1.20)
Dummy variable 2 x Within- group centrality heterogeneity^{+}				5.31** (2.11)
R-Squared (percent)	14.70	15.57	15.77	17.65

Unstandardized coefficients are provided with standard errors in parentheses.

Significance levels: * p<0.05; ** p<0.01.

+: Natural Log transformation

The first group, which is protected by the highest mobility barriers, was designated as the reference group.

Examination of these regression slopes suggests that firm performance is significantly and negatively related to the level of within-group heterogeneity in terms of degree centrality for the group protected by the highest mobility barriers. Thus, each unit increase in the level of within-group heterogeneity in terms of degree centrality for the group protected by the highest mobility barriers is associated with significant performance losses. In contrast, changes in the levels of within-group heterogeneity in terms of degree centrality are not significantly associated with performance variations for other groups protected by less significant mobility barriers. Thus, all else being equal, the lower the level of within-group heterogeneity in terms of degree centrality within strategic group protected by the group protected by the highest mobility barriers, the greater the likelihood of finding significant performance differences across strategic groups.

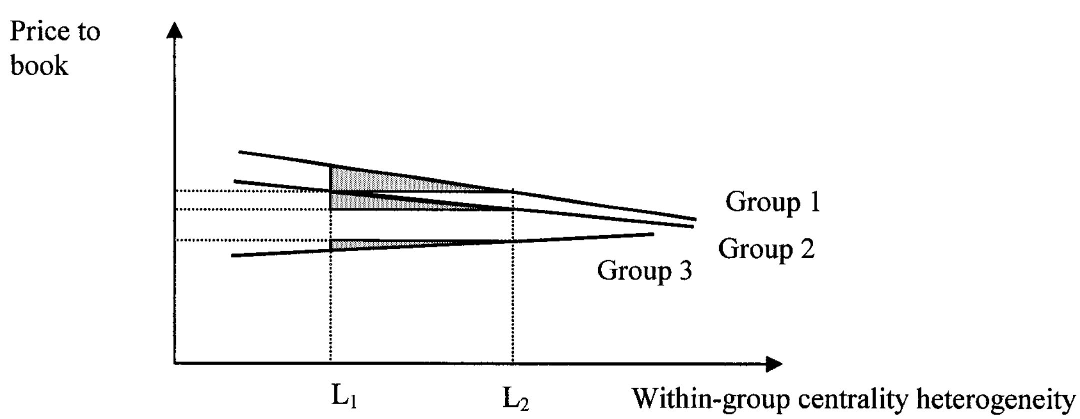

Figure 13: Slopes of price to book on within-group centrality heterogeneity for the three strategic groups in the pharmaceutical industry

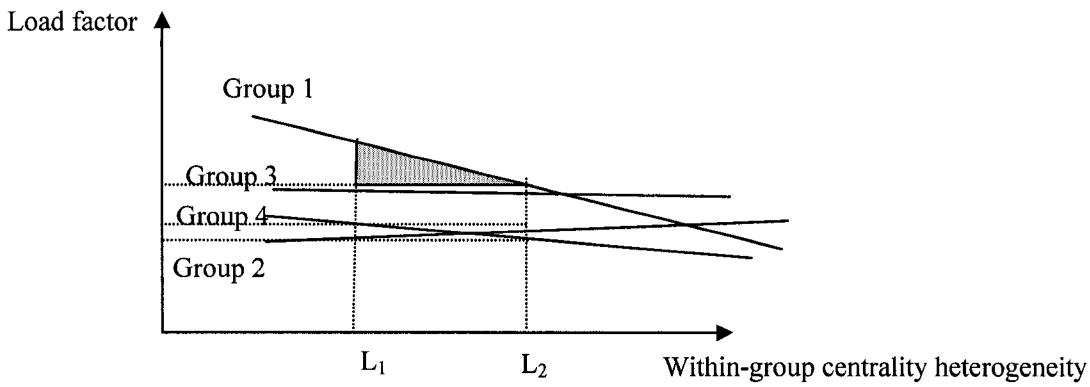

Figure 14: Slopes of load factor on within-group centrality heterogeneity for the four strategic groups in the airline industry

In sum, results from the present study provide partial support for hypothesis 2 and strong support for hypotheses 1, 3 and 4. The major findings of this study are summarized in Table 21.

Table 21: Summary of key empirical results

Hypotheses	**Pharmaceutical industry**	**Automotive industry**	**Airline industry**
H1: Within-group multi-market contact moderates the relationship between strategic group membership and performance	Supported	Supported	Was not tested
H2: Within-group density of ties moderates the relationship between strategic group membership and performance	Was not supported	Was not tested	Supported
H3: Within-group role equivalence moderates the relationship between strategic group membership and performance	Supported	Was not tested	Supported
H4: Within-group heterogeneity in terms of degree centrality moderates the relationship between strategic group membership and firm performance	Supported	Was not tested	Supported

8. DISCUSSION AND CONCLUSIONS

In this study, I have attempted to address the inconsistency of findings in previous strategic group research by suggesting that the level of within-group rivalry moderates the relationship between strategic group membership and firm-level performance. Mainstream strategic group research has either implicitly or explicitly been anchored on the assumption that the mere presence of structural, exogenous, asymmetrical mobility barriers in an industry is sufficient for the members of the group presumably protected by the highest mobility barriers to persistently outperform the members of other groups. Against this backdrop, I adopt a more contextual approach, suggesting that such a relationship is likely to be contingent upon the extent of inter-firm rivalry within strategic groups. Building upon Dranove et al., (1998), I argue that the presence of effective mobility barriers is a necessary, though not sufficient, condition for group members to achieve above-normal profits. The ability of a strategic group to consistently outperform other groups *also* depends upon group members' *conduct*, which is reflected in their capability to coordinate their actions and to limit price wars and other destructive competition inside the group. More specifically, the main argument put forth in this study is that the members of the group protected by the highest mobility barriers must overcome *endogenous barriers* to coordination in order to persistently outperform other groups ranking lower on the mobility barriers hierarchy. If rivalry among members of the group presumably sheltered by the highest mobility barriers is intense, one would expect that group members' ability to successfully raise output prices will be significantly reduced (Barney & Hoskisson, 1990). Therefore no performance differences across groups will be detected, despite the presence of asymmetrical mobility barriers in the industry (Barney & Hoskisson, 1990).

If mobility barriers should be viewed as one element, among many others, that can have significant effect on firm profitability, then, there is no theoretical basis for expecting a universal direct link between strategic group membership and firm profitability. Therefore, the central question becomes: Under what conditions do members of the group protected by the highest mobility barriers are more likely to surmount barriers to coordination?

To address this issue, I integrated arguments from the multi-point competition, the structural embeddedness and the social network literature to identify two important mechanisms through which group members may increase intra-group coordination. The first relies on market-based self-discipline, suggested by the mutual forbearance hypothesis. The second mechanism involves network-based self-discipline implied by the structural embeddedness perspective. Accordingly, I argued that the relationship between strategic group membership and firm performance is likely to be contingent upon the extent of (1) multi-market among firms belonging to the same group, (2) the density of ties maintained among group members, (3) the extent of their role equivalence, and (4) their centrality in the industry's network of strategic alliances.

The empirical findings of this research provide support for all four hypotheses. Indeed, the significant interactive effects observed in both the pharmaceutical and the automotive industries reveal that, all else being equal, the positive impact of within-group multiple point competition on firm performance is much stronger for the groups protected by the highest mobility barriers than for other groups ranking lower on the mobility barriers hierarchy. Consequently, our data indicates that, all else being equal, the higher the extent of within-group multiple point competition within the most protected group, the greater the likelihood of finding significant performance differences across strategic groups.

The moderating effect of the density of ties among group members on the relationship between strategic group membership and performance has received strong support in the airline industry. More specifically, results suggest that, the positive effect of within-group density of ties on airline load factor is much higher for the group protected by the highest mobility barriers than for the other three groups surrounded by lower regulatory mobility barriers. These findings provide support for our theoretical arguments suggesting that the higher the density of ties within the most protected group, the higher the likelihood of finding significant performance differences across strategic groups in an industry. It should be noted, however, that the moderating effect of within-group density of ties on the performance implications of group membership has not received empirical support in the context of the pharmaceutical industry. In my opinion, this result should not be surprising since it is primarily due to a methodological, rather than a conceptual, consideration. Indeed, the level of within-group density of ties (the main independent variable) in the context of pharmaceutical industry has not significantly changed over the four-year period investigated. An independent variable which exhibits low variance is unlikely to be correlated with any dependent variable. A possible solution to this problem would be to enlarge the time frame of the analysis in order to allow for more variance in the dependent variable. This was not possible, however, because the time period under study had to be a 'Strategically Stable Time Period' (Cool & Schendel, 1988; Fiegenbaum, Sudharsan & Thomas, 1990).

Strong empirical support was also found, in both the pharmaceutical and the airline industries, for the hypothesis suggesting that within-group role equivalence moderate the relationship between strategic group membership and firm performance. This result is of particular importance since it highlights the significant effects of *symbolic* communication triggered by the "role" associated with the structural position occupied by members of the group protected by the highest mobility barriers in the overall network of alliances (Galaskiewicz & Burt, 1991; Gulati, 1998; Mizruchi, 1993).

Finally, in support of the idea that within-group heterogeneity of network resources moderates the performance consequences of strategic group membership, the results show that performance of firms belonging to the groups protected by the highest mobility barriers, in both the pharmaceutical and the airline industries, is negatively correlated with the level of within-group heterogeneity in terms of degree centrality. In contrast, within-group heterogeneity in terms of degree centrality has little effect on performance of firms belonging to groups protected by less significant mobility barriers.

These findings contribute to the literature on strategic groups, strategic alliances and multimarket competition in several ways. First, the results of this study provide further evidence that the relationship between strategic group membership and firm performance exists, but only in particular setting and under certain conditions. In their meta-analysis, Ketchen et al. (1997) highlighted some of the methodological issues affecting the magnitude of the organizational configuration-performance link. In particular, their mata-analysis revealed that strategic group membership contributed more to firm performance when researchers (1) selected a sample from a singe industry, (2) adopted a longitudinal design and (3) employed a broad definition of resource configuration. Similarly, in their theoretical paper Dranove et al. (1998) suggested that strategic groups can have a persistent impact on firm performance only when the extent of strategic interactions among strategic group members is significantly high. What I have undertaken in this paper can be viewed as a further step in the same direction. Indeed, my empirical results suggests that, all else being equal, the higher the (1) the level of multimarket contact (2) the density of ties, (3) the role equivalence and (4) homogeneity in terms of network resources among members of the group protected by the highest mobility barriers in the airline, automobile and pharmaceutical industries, the higher the likelihood of finding a significant relationship between strategic group membership and performance. This result represents an important advance in strategic group research since it confirms the crucial role played by the level of multimarket contact among group members as well as the structure of strategic networks within groups in affecting the magnitude of performance differences across strategic groups.

Second, by pointing to the important role of both multi-market contact and structure of networks of inter-firm ties in understanding the implications of strategic group membership on firm performance, this study fills a major gap in previous research which has largely overlooked the effects of the structure of competitive and cooperative relationships in which group members are embedded. In most cases, mainstream strategic group studies cluster firms sharing the same *attributes* (size, advertising intensity, R&D intensity) into groups, without regards for the structure of competitive and cooperative relationships in which these firms are embedded[10]. Such attribute analysis takes for granted that the level of within-group multimarket contact is equal among all strategic groups in the industry. In addition, it assumes that firms have no strategic alliances at all, or at best, that the patterns of their intra-group and across-groups linkages are random. However, given the important implications of multimarket contacts and network configurations highlighted in this study, it seems that analyzing the performance effects of strategic groups independently of group members' market and network positions strongly eclipses the complex dynamics underlying persistent performance differences in an industry.

Just as consideration of multimarket competition and alliance networks contributed to our understanding of the dynamics underlying the strategic group-performance relationship, inclusion of the strategic group concept in the multimarket competition and alliance networks literature may enrich our understanding of the performance effects of both mutual forbearance hypothesis and firm position in the network of alliances. Indeed, the

[10] Nohria and Garcia-Pont (1991) and Garcia-Pont and Nohria (2002) studies are among the rare exceptions.

theoretical framework and the empirical findings described in this study suggest a contingency view of the mutual forbearance hypothesis and strategic alliances. That is, it suggests that multimarket contact will lead to mutual forbearance, and therefore have a positive effect on performance, only when firms are similar along certain key strategic dimensions (i.e. when they are members of the same strategic group) **and** when these similar firms, as a group, are protected by high mobility barriers. Similarly, it suggests that strategic alliances among members of groups protected by high mobility barriers provide significant performance effects, while alliances involving members of strategic group surrounded by low mobility barriers are likely to generate insignificant performance effects.

From a managerial viewpoint, the results of this study provide further evidence that the strategic group concept has the potential of being a precious theoretical and analytical tool for managers. Indeed, the strategic group framework allows managers to visualize the different viable strategic positions in an industry. In addition, it provides them with the opportunity to map the distribution of resources and capabilities among firms within an industry, and hence, to better assess the structure of competition and the balance of power among industry members. However, in order to fully understand how firms belonging to groups protected by high mobility barriers enhance and protect their superiority, managers should combine the strategic groups map with two other pertinent maps: the first depicting the structure of multimarket contacts among group members and the second portraying the structure of alliance networks within the industry. If, as the results of this study suggest, structural configuration of within-groups' multimarket contact and alliance networks influences firm competitive behavior, and hence their performance, then managers should give more attention to the structural properties of market contacts and networks in order to restructure the network to their advantage.

The results of this study suggest an important implication for antitrust policy. Our findings suggest that high levels of multimarket contacts, density of ties, role equivalence and homogeneity in network resources among members of strategic groups protected by the highest mobility barriers allow those firms to exercise and reinforce their market power (i.e., set prices above the competitive level). Accordingly, this study provide further evidence that antitrust regulators, which have focused most of their attention on deterring or preventing mergers and acquisitions that lessen competition within a market, should also closely monitor the evolution of the structure of multimarket contact and strategic alliance networks.

A number of avenues for future research emerge from the findings of this paper, as well as from some of its limitations. First, this study examined the effect of only two key factors – multimarket competition and alliance networks- known to have a significant influence on the level of within-group oligopolistic coordination. Future research should explore the moderating role of other group characteristics, which may affect the level of coordination inside and across groups. For instance future research could investigate the potential moderating effect of factors such geographic proximity of group members, group membership stability over time and group identity (Dranove et. al, 1998). In addition, future research should examine the two- and three-way interactions among multimarket competition, density of ties, role equivalence and heterogeneity in network resources concepts.

Second, the three samples drawn from the pharmaceutical, the airline and the automotive industries used in this study have a bias toward larger public firms. This bias is a common limitation of research relying on published sources of data such as S&P's Compustat and Worldscope (Young et al., 2000). Future research should also examine the impact of multimarket competition and network alliance structures on strategic group performance implications using other research settings (i.e., samples, time frames) and performance indicators for more confident generalization.

Finally, and most importantly, this study measures within-group inter-firm rivalry inferentially, rather than directly. In other words, the level of within-group rivalry was inferred in this study from measures of multi-market competition and positions in the network of strategic alliances, rather than from actual competitive behavior –actions and reactions- of firms. This drawback is noticed in most studies drawing upon the Structure-Conduct-Performance paradigm from industrial organization economics (Smith et al., 1997). For example, Cool and Dierickx (1993) assessed the level of rivalry within and between strategic groups in the pharmaceutical industry indirectly using Herfindahl-like indices from which the squared market share of the focal firm was subtracted. Similarly, Peteraf (1993) inferred inter-firm rivalry using average price/cost ratios, while Sandler (1988) assessed the degree of rivalry using measures of market share instability. Future research should adopt a more fine-grained measure of inter-firm rivalry by assessing the frequency and severity of competitive moves and countermoves directly as advocated by the dynamic strategy literature (Chen et al, 1992; Smith et al., 1992; Young et al., 2000). Such approach will undoubtedly benefit scholars interested in performance consequences of strategic groups as it can provide them with potential explanations for one of the most fundamental questions in strategic management research: Why and how firms, or groups of firm, differ in performance.

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