INTRODUCTION

Strategic groups are one dimension of an industry's structure, and understanding their dynamics enriches traditional models of industrial economics. In particular, group-level dynamic interactions considered in the developments in oligopoly theory focus on market interactions wherein a firm's action affects those of its rivals (see Spiller and Favaro, 1984). This approach provides a useful means of predicting the nature of competition. This dimension of structural analysis is also relevant to streams of strategic management research that study the persistence of profits or of competitive interactions between firms (Peteraf 1993). An interesting question that has emerged from this research is whether rivalry is greater between members of different groups or between members of the same group (Porter, 1979; Hatten and Hatten, 1987). Nevertheless, researchers have suggested that the fundamental question relates not to comparisons of inter- and intra-group rivalry, but rather to how groups act competitively (see Smith, Grimm, and Wally, 1997). These researchers point out that competition and collusion are not mutually exclusive and that a variety of combinations of collective and competitive actions can exist simultaneously (Dranove, Peteraf, and Shanley, 1998).

Mas-Ruiz and Ruiz-Moreno (2011), who focus on firm behavior *within* a strategic group, consider the degree of rivalry to depend on the size of the firms (hereinafter, firm size) that constitute the group. They propose that lower levels of rivalry are more likely to exist within a group of large as opposed to smaller firms owing to certain group-level effects, such as market power, efficiency, differentiation, and multimarket contact. Mas-Ruiz, Nicolau-Gonzálbez, and Ruiz-Moreno (2005), on the other hand, examine the extent to which asymmetric rivalry operates *between* size-defined strategic groups. They propose that groups comprising smaller firms respond more strongly to competitive actions originating in a group comprising large firms than vice versa. These results suggest that significant group-level effects are involved in both inter- and intra-group rivalry. Both studies analyze the period after the end of the open war that followed the deregulation of the banking industry.

In their respective focuses on *intra*- and *inter*-group rivalry, however, these studies provide only a partial description of an industry's patterns of competitive behavior. We extend this analysis by studying both intra- and inter-group rivalry during, rather than after, the open war that followed deregulation. In particular, after a deregulation of prices in an industry, there is no place for leader-follower asymmetric behavior and the pacifist attitude of large firms facing high switching costs. On the contrary, the new situation is characterized as a dominant-fringe asymmetric behavior, where the large firms have to assume an aggressive attitude in order to capture a client base. In the same way, if large firms, owing to their economies of scale (i.e., efficiency), set lower prices than their smaller rivals do, they will eventually enjoy a complete dominance of the market. We therefore predict an asymmetric rivalry of a 'dominant-fringe' type, with groups comprising large firms expecting to experience a large amount of retaliation from firms within their group and accommodation from groups comprising smaller firms, and groups comprising small firms expecting to experience a small amount of retaliation from the group comprising large firms and no reaction from the other firms in their group.

We study the presence of asymmetric rivalry within and between size-defined strategic groups by estimating the effect of group-level strategic interactions on firm performance through a model based on the New Empirical Industrial Organization (NEIO) framework. We conduct an analysis of data from the Spanish bank-loans market between 1992 and 1994 (the period after deregulation), using the approach of Dranove *et al.* (1998) as well as the history of the industry (Peteraf, 1993) to identify strategic groups according to firm size. Our study reveals that the rivalry within and between groups is asymmetric, which supports a dominant-fringe relation between firms, as described in our hypotheses.

THEORY AND RESEARCH HYPOTHESES

Prior literature on strategic groups has considered the following topics: the emergence of groups; intra- and inter-group rivalry; performance differences between groups; and the stability of a group structure.

i) The emergence of strategic groups. Several theories describe the nature of strategic groups and how they are formed, explaining why a firm might hew to the strategies of its fellow group members but diverge from those of firms outside of that group. In particular, Dranove *et al.* (1998) focus on firms' strategic interactions—that is, the extent of the cooperative and competitive actions between firms—to develop a theory of how strategic groups form. According to the authors, a strategic group exists only if the performance of its member firms is a function of the group characteristics. While group members' strategic interactions are critical to group-level effects on performance, mobility barriers bolster these effects by deterring competitors from entering the group and by enhancing the strategic interactions among group members. An important implication of this approach is that, while a group may be identified in various ways, unless its identity is based on the actual behavioral relations and interactions among its member firms, the so-called group is really simply an artifact and therefore relatively unimportant to any analysis. One empirical approach to establish whether a so-called strategic group in fact exists is to demonstrate that group-level strategic interactions affect the performance of the individual group members.

We build on this approach by arguing that groups display interactions as a function of the size of their member firms. We hypothesize that, owing to several forms of group-level effects, including switching costs and efficiency, the asymmetric rivalrous behavior within and between strategic groups is determined by the size of their members. While rivalry remains our focus, it is rivalry's link to performance that allows us to determine whether group interactions derive from the size of the group's members. In particular, we estimate firm performance by using a model based on the New Empirical Industrial Organization (NEIO) framework and thus we establish whether size-defined strategic groups exist. This empirical approach is complemented with the history of the industry to identify strategic groups according to firm size. Such analysis of the history is also among the most widely accepted approaches to explain the configuration of strategic groups (see Porter, 1979; Peteraf, 1993).

ii) Rivalry within and between strategic groups. The literature examines whether strategic groups can serve as a means for understanding the strategic behavior of firms in an industry. Porter (1979) viewed strategic groups as persistent structural features of industries bounded by mobility barriers, which serve to limit entry into the group by preventing imitation (Caves and Porter 1977). Implicit in the concept of mobility barriers is the idea that the degree of rivalry differs both within and between groups (Porter 1976; Peteraf 1993). Nevertheless, the literature on intra- and inter-group rivalry is ambiguous. While some authors argue that the rivalry between groups is greater than the rivalry within groups (see Hunt, 1972; Caves and Porter, 1977; Newman, 1978), this idea has also been criticized in the literature (see Cool and Dierickx, 1993; Smith *et al.*, 1997; Peteraf and Shanley, 1997).

In consequence, determining whether rivalry is greater between or within groups becomes a difficult proposition. Alternatively, Smith *et al.* (1997) suggest that the fundamental question pertains not to a comparison of intra- and inter-group rivalry, but rather to the behavior of groups themselves. Our study attempts to determine whether the rivalry within and between groups is determined systematically and predictably in terms of asymmetry. We build on several recent works (e.g., Dranove *et al.* 1998) whose theories of strategic groups hold that the group's identity is based on the actual behavioral relations and interactions among its member firms. Accordingly, we argue that the degree of asymmetric rivalry within and between groups depends on the firm size, where size serves as a proxy for group interactions, and we predict an asymmetric dominant-fringe behavior.

iii) Performance difference between groups. Related to the definition of strategic groups is the question of whether we can predict a firm's performance based on the group to which it belongs. The earliest theorists of strategic groups held that change produces rigidities because of barriers to mobility. This provided members of strategic groups with a relative cost advantage over other firms (Porter, 1979). Indeed, adopting a group structure would make no sense unless it protected against and imposed costs on outsiders' attempts to imitate group members. Thus, differences in performance between group members and outsiders tend to persist in the medium to long term (McGee and Thomas, 1986).

However, some studies maintain that mobility barriers provide insufficient theoretical support for the connection between group membership and performance. Along these lines, recent studies have integrated mobility barriers into a new theorization of the strategic group, one based on members' strategic interactions. Thus, Dranove *et al.* (1998) focus on the performance effects of intra-group behavior. Group-level effects on performance derive from the market power, efficiency, or differentiation produced by the members' strategic interactions. While group members' strategic interactions are critical to group-level effects on performance, mobility barriers help to sustain the group-level effects these strategic interactions produce by deterring competitors from gaining entry into the group and by enhancing the strategic interactions among members.

We extend these ideas by focusing on the link between asymmetric rivalry and performance; specifically, we use this link to determine whether the interactions displayed by groups are a function of the size of their member firms. The group-level effects on performance derive from switching costs and efficiency.

iv) Stability of a group structure. The strategic groups are dynamic structures that grow, evolve, and decline on time. A line of research in the literature analyzes the dynamic characteristics of these structures in terms of changes in the number of strategic groups, its strategies, and its mobility. Most of the empirical work in this area finds that the strategies and composition of groups change over time (see Hatten and Hatten, 1985). Some studies identify periods of homogeneity in the strategies of the firms in an industry that are interrupted by periods of change, which are often precursors to the formation of strategic groups. This approach draws on the theory of organization (Fiegenbaum *et al.* 1987) and assumes that the environment of the organization is unstable and that firms try to adapt their behavior to its changes. This response to changes in the environment could cause an unusually high number of firms to change their strategies and could promote the adoption of collective strategies among the group members. Other researchers (e.g., Cool and Schendel, 1987, 1988; Cool and Dierickx, 1993; Fiegenbaum and Thomas, 1990, 1993; Fiegenbaum *et al.* 1990) argue that firms modify their strategies as a response not only to changes in the industry's environment, but also to the imitation actions other firms engage in for the purpose of copying their behavior, as well as to the market´s reception of how they have positioned their products therein. This line highlights organizational autonomy and managerial discretion, and it keeps the key role of the industry structure.

We extend these approaches by focusing on the strategic interaction among group members as a response to changes in the environment (i.e., deregulation) as well as to rivals' imitation activities or to the market. Specifically, we predict that, through the dynamic effects of switching costs and efficiency, firm size will affect group behavior after an industry is deregulated, resulting in a specific asymmetric rivalry.

Hypotheses of asymmetric rivalry within and between size-defined strategic groups

The theory of asymmetric similarities between two objects (Tversky, 1977) has been applied to competitive behavior at the firm level. Thus, a competitive relationship between two firms can be asymmetric, that is, it can change as a function of which competitor is under consideration (Chen, 1996). It does not necessarily follow, for example, that if A is the main competitor of B, then B is the main competitor of A. At the strategic-group level, the first references to asymmetric competition are made by Porter (1979) and Hatten and Hatten (1987), both of whom observe that mobility barriers, and the patterns of rivalry that result therefrom, may not be symmetrical. This observation further suggests that a given firm will make predictions about its competitors' reactions based on the group (i.e., the firm's group or a different group) to which the competitors belong. DeSarbo and Grewal (2008) later argue that competition among firms depends on the degree of overlap among strategic groups, that is, competition varies depending on whether a firm is pure or hybrid, with pure-group firms competing more intensely with one another than with firms in hybrid groups that overlap with this pure group.

In any case, there is insufficient research on asymmetric rivalry at the level of the strategic group. One work on the subject—Mas-Ruiz *et al.* (2005)—focuses exclusively on inter-group rivalry, that is, the competitive response of a member of a different group, and characterizes the rivalry between size-defined strategic groups as asymmetric and of the leader-follower type, as defined by Stackelberg. Essentially, Mas-Ruiz *et al.* (2005) assumes that strategic groups comprising smaller firms are more responsive to the competitive actions of groups comprising large firms than vice versa. This behavior of the smaller firms, what Stackelberg calls follower behavior, is a clear example of puppy dog behavior, a term Fudenberg and Tirole (1984) apply to the following taxonomy of behavioral strategies.

Specifically, Industrial Organization defines four types of optimal behavioral strategies (Fudenberg and Tirole, 1984) that an established firm (hereafter, the incumbent) can adopt as a response to the treat of an unestablished firm (hereafter the entrant or the competitor). The appropriateness of the strategy depends on the effect of the incumbent's strategic investment (e.g., capacity, advertising, among others) on its own profitability, the slope of the entrant's reaction curve, and whether the incumbent chooses to accommodate or deter new entrants.

i)The top dog: If a high level of investment (e.g., the incumbent's client base) makes the incumbent look tough (because its bigger clientele reduces the market availability and the profit potential for the entrant), and the reaction curves have negative slopes (e.g., the entrant would cower and produce less), the incumbent should adopt the top-dog strategy (i.e., overinvestment: being big or strong to look like tough and aggressive) to deter the entrant or induce its accommodation (a softer behavior). However, if the investment level makes the incumbent look tough and the reaction curves have positive slopes, the incumbent could also adopt the top-dog strategy to deter the entrant (Tirole 1989).ii) *The puppy-dog ploy*: If the investment increases the hardness of the incumbent and the reaction curves have positive slopes, the incumbent should adopt a puppy dog strategy (underinvestment: being small or weak to look soft and inoffensive) in order to accommodate the entrant and to avoid triggering an aggressive reaction from the entrant. That is, the incumbent puppy dog underinvests in order to appear friendly to a new entrant, given that the incumbent expects entry to occur (Gilbert 1989). For example, in order to accommodate entry, the incumbent prefers the entrant to believe that the incumbent' costs are relatively high by reducing its quantity offered. iii) *The lean and hungry look*: If the investment makes the incumbent look soft and the reaction curves have negative slopes, the incumbent should keep a lean and hungry look (underinvestment: being small or weak to look tough and aggressive) to accommodate or deter the entrant. For example, the incumbent will underinvest in advertising to deter entry, because by lowering its stock of 'goodwill' it establishes a credible threat to cut prices in the event of entry. However, if the investment makes the incumbent look soft and the reaction curves have positive slopes, then the incumbent should also keep a lean and hungry look (underinvestment) in order to deter the entrant. iv) *The fat-cat*: If the investment makes the incumbent look soft and the reaction curves have positive slopes, then the incumbent should overinvest to become a fat cat (being big or strong to look soft and harmless) in order to accommodate the entrant by committing the incumbent to play less aggressively thereafter. By appearing soft, the fat cat encourages its rival to be less aggressive (Gilbert, 1989). For example, if the incumbent chooses to allow entry, it will advertise heavily and become a fat cat in order to soften the entrant's pricing behavior.

Mas-Ruiz *et al.* (2005) applies these four types of optimal behavioral strategies to the Spanish banking industry and finds evidence of a voluntary limitation of capacity, which is an example of puppy dog behavior on the part of the entrant. In line with this result, the model of Gelman and Salop (1983) assumes that the entrant follows a puppy-dog behavior. By committing itself to a low investment strategy (to some limited capacity), the entrant projects a friendly image that is intended to invoke a more accommodating attitude in the incumbent. Thus, the entrant enters the market on a very small scale in order to avoid triggering an aggressive response in the big incumbent. The entrant agrees to refrain from accumulating a large capacity as a way of tacitly agreeing not to engage in an aggressive pricing strategy, since there is no reason to reduce the price when you cannot satisfy the demand. Gelman and Salop coined the phrase 'Judo economics' to refer to this entrant strategy of setting a low enough price and constraining capacity. At the level of size-defined strategic groups, Mas-Ruiz *et al.* (2005) find that in the period following an open price war for market share, wherein large firms have increased their share through that war, large firms, having 'fattened up' and now facing the high cost of maintaining low prices, are incentivized to moderate their activity. In the meantime, medium and small firms act as puppy dogs, maintaining their limited capacity for output capturing, which commits them to avoiding aggressive pricing strategies by offering relatively low-price output, and therefore posing no threat to the large institutions. This asymmetric leader-follower behavior is apparent in the Spanish deposit market of 1994, which came after the end of the open price war for deposits between 1989 and 1992 that followed the deregulation process.

Our study conversely assumes that such asymmetry extends to both intra- and inter-group rivalry, and focuses on the price war following deregulation. Specifically, we propose, first, that the group comprising large firms will expect to experience a large amount of retaliation from other large firms in their group and accommodation from members of the group comprising smaller firms and, second, that the group comprising small firms will expect to experience a small amount of retaliation from the group comprising large firms and no reaction from other small firms in their group. Essentially, we argue that asymmetric rivalry within and between groups depends on the size of firms that constitute those groups. Moreover, we argue that, as a function of firm size, groups display different group interactions that, in turn, explain the performance of their member firms. Firm size can affect group behavior through different effects, such as switching costs and efficiency.

Switching costs as group-level effects derived from firm size. In many markets, clients face significant switching costs when they change firms. These markets are characterized by consumer lock-in: consumers repeatedly buy the same brand even after competitor brands become the cheaper option (Shy, 2002). Klemperer (1987) has confirmed theoretically that consumer switching costs confer market power on firms. High switching costs tend to reduce competition between firms because they create captive clients who can be 'squeezed'. In this sense, in markets where consumers face high switching costs, market share and firm size determine firm profits in that income derived from market power increases with the size of the client base. Conversely, low switching costs promote competition because they incite firms to lower their prices in order to attract clients. In addition, in some industries the switching costs vary with the consumer; in the banking industry, for example, switching costs decrease as the consumer's wealth increases. Firms belonging to such industries can effectively implement market segmentation through price discrimination and therefore can coexist at different levels of rivalry.

Some researchers (e.g., Tirole, 1989) consider this segmentation to be a particularly good example of the taxonomy of the four optimal behavioral strategies of Fudenberg and Tirole (1984). Here, the incumbent's strategic investment can be treated as equivalent to the client base the incumbent enjoyed before the competitor's entry (e.g., investment would reflect the expenses necessary to make changing their supplier costly for some of the incumbent's clients). In particular, the switching-costs model of Farrell and Shapiro (1988) shows how a big firm can 'exploit' its client base by setting a high price while a small firm sets a low price to attract young clients and form its own client base. According to Fudenberg and Tirole (1984), under these circumstances and at the level of size-defined strategic groups, large firms will act as *fat cats* who exploit their existing client base with higher prices, while smaller firms act as puppy dogs who attempt to attract and establish a client base using lower prices. Along these lines, different members of the banking industry can specialize in different segments of the population. Consider a bank that invests in an extensive branch network to maintain a broad and stable client base that is risk-adverse and has no alternative banking opportunities owing to high switching costs. This bank thereby establishes a reputation for solvency and, as a fat cat, will not have to use pricing to compete aggressively (it will collude with other banks) and will enjoy high profit margins. Alternatively, consider a bank that invests in a narrow branch network, competes aggressively through pricing, and works with a smaller client base that has a risk-friendly attitude and better information, along with low switching costs. This bank is behaving as a puppy dog, with no intention of becoming a large bank. In sum, asymmetric behavior of the leader-follower type, as elaborated by Stackelberg, manifests, whereby a follower firm reacts to changes in its rivals' actions (in other follower firms as well as leader firms), while a leader firm does not (Putsis and Dhar, 1998).

In general, the previous model assumes that markets with switching costs are stable and comprise large firms that act as less aggressive fat cats while more aggressive smaller firms race to compete with the larger ones. However, as Farrell and Klemperer (2007) argue, the opposite scenario is also possible; large firms may also act as more aggressive top dogs. Thus, the switching costs themselves can serve to introduce important dynamic effects (Gual and Vives, 1991).

The tacit agreements that large fat-cat firms make regarding output, such as maintaining high prices in output markets, can in turn threaten the stability of these markets in a deregulated frame. In theory, such firms are incentivized to break these tacit agreements and start a price war. If a large firm believes that the other members of its group will uphold their agreement to charge a high price and maintain a stable share of production, then this firm may decide to exploit this agreement and produce more than its assigned share of production, thereby profiting from the fact that the other firms will maintain their high prices. In other words, such a firm may be incentivized to reduce its prices in order to attract more clients, thereby increasing its profitability at the other group members' expense and, in the process, transforming from a fat cat into a top dog (Gual and Vives, 1991). This firm would then be positioned to be the first to attack with a low bid in order to capture clients. Moreover, the dynamics of switching costs will augment the advantage that comes with being the first to bid, given that clients attracted by a firm's good bid tend to stay with that firm, even when other firms launch similar bids. Given this new strategy of attack and assuming that a fat cat will be unwilling to accept an important loss in its market share, there will be no peace, and the other group members will be forced to reckon with the top dog's aggressive tactics and enter the price war. In this context, top dogs compete aggressively to capture a larger client base and thereby increase their capacity, in the process directly threatening the market share of other large firms, as well as those of small and medium firms.

In the taxonomy of Fudenberg and Tirole (1984), this behavior falls into the top dog category, whereby the incumbent overinvests in order to deter new competitors from entering the market, which is the optimal deterrence strategy in models such as Spence (1977) and Dixit (1981). Investment makes the incumbent appear tough and, in response, the entrant cowers and produces less (the reaction curve is downward sloping). Top dog behavior is optimal in this case, whether or not the entrant is actually prevented from entering the market. Even if entrance is allowed, as in the Dixit model, the incumbent will play the top dog role to increase its profits thereafter (Gilbert, 1989). In the same way, in the field of price leadership or the dominant firm model, this type of behavior would be an example of cartel without full market share, where the dominant firm acts as a price-setting firm with a large market share facing smaller price-taking firms (a competitive fringe). For example, Spiller and Favaro (1984) detect in the Uruguayan banking system that dominant firms behave as an implicit or explicit cartel *vis-à-vis* the other dominant firms, but as Stackelberg leaders *vis-à-vis* the fringe firms. That is, firms in the dominant group expect strong retaliation by firms in their own group, but accommodation by firms in the fringe group. Putsis and Dhar (1998) also reference this dominant-fringe asymmetric behavior in the sense that a fringe firm behaves cooperatively, while a dominant firm competes in a non-cooperative fashion. We observe such dominant-fringe asymmetric behavior during the deregulation of the Spanish banking industry, which was characterized by a war to capture market share (Gual and Vives, 1991).

Given the above, the dynamic effects of switching costs in terms of capturing a client base may explain the asymmetrical rivalry within and between size-defined strategic groups. In particular, in the period following a price deregulation in a market wherein switching costs are not the same for every client, there is no room for the pacifist attitude of a fat cat, as exemplified in leader-follower asymmetric behavior. Under these circumstances, large firms must assume the aggressive attitude of a top dog—as is also exemplified in dominant-fringe asymmetric behavior—and thereby directly threaten the market share of other large firms, as well as those of small and medium firms.

Efficiency as group-level effect derived from firm size. According to the efficient structure hypothesis (Demsetz, 1973), concentration or market share is associated with both more favorable prices for consumers—if some of the savings achieved through efficiency are passed on to consumers, possibly to secure a dominant market share—and higher profits. Furthermore, this hypothesis points to the existence of economies of scale and scope as, most often, the best explanation for the important behavioral differences we observe in firms of different sizes. Large firms, for example, might have lower costs of production than smaller firms do and, then, might secure higher profits. If their reduced costs derive from joint production of several products and services, then large firms might also more easily offer their clients a wide portfolio of complementary products and services.

Given the taxonomy of Fudenberg and Tirole (1984), the model of Farrell and Shapiro (1988) identifies an optimal strategy for large fat-cat firms to pursue that simultaneously considers economies of scale and switching costs: in the presence of economies of scale, a customer base with switching costs can lead an established firm to accommodate entry when preventing entry would be more efficient. Moreover, the incumbent has an incentive to price higher and keep its old customers. This result parallels the situation with learning (Gilbert, 1989): while it would be more efficient for the firm with lower costs to price low and exploit experience economies, the firm may instead choose to exploit its low cost by pricing high and accommodating entry. Similarly, the firm with an established customer base could price low and deter entry or price high, keep its old customers, and accommodate entry. If economies of scale are not too great, the latter course of action is the best strategy.

This simple model assumes that markets with switching costs are stable, and that larger firms act as less-aggressive fat cats while the more aggressive smaller firms race to compete with them. However, as Farrell and Klemperer (2007) argue, the opposite scenario is also possible when simultaneously consider economies of scale and switching costs in an oligopoly dynamics; in this case, large firms may act as more aggressive top dogs. If large firms have low marginal costs, and especially if these firms, owing to their economies of scale, are able to push smaller firms out of the market, then large firms could set their prices lower than those of their smaller rivals. In this situation, wherein large firms set lower prices than their smaller rivals do, any small advantage a large firm enjoys could be augmented and the positive feedback dynamics (word-of-mouth communication) could result in that firm's complete dominance of the market. This dynamic mirrors that of network effects, which arise when consumers value compatibility with other consumers, creating economies of scope between different consumers' purchases: indeed, switching costs create positive network effects because it is more attractive to buy products from a firm whose products other consumers are already buying, given that the more consumers buy a product, the more highly other consumers value that product (Beggs, 1989). Accordingly, like network effects markets, switching costs markets can 'tip.'

An example of these dynamic effects is considered by Gual and Vives (1991) in the context of bank deregulation: when price deregulation takes place, the switching costs increase the advantages associated with being the first in a group comprising large firms to break any existing tacit agreements, launch into attack mode with the aim of commanding a greater market share, and thereby start a price war. This type of competition among large firms is reinforced by economies of scale, as by expanding their client base large firms can also reduce their unitary costs. In fact, in the Spanish banking sector, large banks exploit economies of scale at the level of the branch through increasing their per-branch number of accounts. Furthermore, the network effects are visible in banking: inherent in occupying the position of market leader is the differentiation of your product from all others in the market, and given that most consumers apply the 'what the majority buys must be the best' election criteria in order to reduce seeking costs, this constitutes a major advantage (Rhoades 1985).

To sum up, according to Farrell and Klemperer (2007), under these circumstances and at the level of size-defined strategic groups, the economies of scale together with switching costs support a strong rivalry between the large firms and allow large firms to retaliate against smaller firms. On this basis, group-level effects (switching costs and efficiency) may explain the asymmetrical rivalry within and between size-defined groups. Furthermore, given that a deregulated industry threatens firm stability, we expect to find that the rivalry within and between size-defined strategic groups is asymmetric and of the dominant-fringe type. Thus, we propose the hypotheses:

H1: In a deregulated industry, the members of the group comprising large firms expect to experience a large amount of retaliation from other members of their group and accommodation from the members of strategic groups comprising smaller firms.

H2: In a deregulated industry, the members of the group comprising smaller firms expect to experience a small amount of retaliation from the members of the strategic group comprising large firms and no reaction from the other members of their own group.

METHODOLOGY

Our study uses the theory-based empirical approach presented in Dranove *et al.* (1998) to identify distinct group-level effects. It considers that a strategic group exists if the performance of a firm is a function of group characteristics, controlling for firm and industry characteristics. In this way, the approach must allow us to distinguish between ‘true’ (group-level) and ‘spurious’ (firm or industry-level) effects. Specifically, we develop a model based on the NEIO framework to determine whether a strategic group actually exists. Through estimating conjectural variations (see Amit et al 1988) based on strategic interactions, this model allows us to test for the existence of asymmetric rivalry within and between strategic groups defined by the size of their members.

Basically, conjectural variations reflect agents’ adaptation of their expectations about a firm’s strategic behavior as a function of past experience. We estimate conjectural variations related to responses to decisions of output (quantity) within and between each size-defined strategic group in the Spanish loans market. This quantity competition in the banking industry can be interpreted as a competition of production capacities (Tirole, 1989), which include investments in the geographical expansion of financial entities as well as in improving technological and human capital (Gual and Vives, 1991). To estimate our conjectural variations, we propose an oligopolistic competition model wherein product differentiation is captured through service quality, which varies with the branch network and the service personnel in those branches. This type of loans competition at the branch level has characterized the Spanish banking system since the 1980s. Therefore, we can capture rivalry during this period by interpreting the model wherein entities modify their loans offers in reaction to the actions of other entities, given that entities compete in both the opening of new branches and the hiring of service personnel to offer loans. In our case, the conjectural variation is a strategic group's subjective estimation of the effect of increasing their offer by 1% over the amount offered by another group.

We assume that the loans market is composed by n financial firms ($i=1,\dots,n$). The n firms can be ranked by output size and formed into s ($h=1,\dots,s$) mutually exclusive groups (Gollop and Roberts, 1979) (for a historical analysis of the strategic groups size-defined in the Spanish banking industry as well as for a delimitation of their members, see 'Strategic groups in the Spanish banking industry' and 'Sample and Variables', respectively). Let's define $s+1$ benchmark firms: the largest one for each of the s groups and the smallest one of the industry. Therefore, every non-benchmark firm i is located between its two neighboring benchmark firms, b and $b+1$. While the model only parametrically specifies the conjectures of the $s+1$ benchmark firms, the conjectures of the non-benchmark firms can be expressed as linear combinations of the conjectures of benchmark observations. The closer the size of firm i is to that of the benchmark firm, the greater firm i's role in the estimation of the benchmark firm's conjectural variations. This framework explicitly incorporates the hypothesis that firms of a similar size are more likely to have a similar vector of conjectures across the s size classes.

This model is built to simultaneously consider the specifications of demand, cost, and rivals' reactions. More precisely, our model expresses, for the semi-logarithmic model of conjectures, the following first-order conditions of firm i, whose size lies between a benchmark b and $b+1$,

$$\frac{r_{li}-r-Cmg_i}{r_{li}}=-\frac{S_i}{\varepsilon_l}\left[1+\sum_{h=1}^{s}\left(\sum_{\substack{j\neq i\\ j\in h}}y_{1,\,j}\right)\left(pond_b CV_{b,\,h}+pond_{b+1}CV_{b+1,\,h}\right)\right]\left[1-\frac{v_i}{r_{li}}\right] \qquad (1)$$

Similarly, the first-order condition for the logarithmic model of the conjectures for firm *i*, whose size lies between the benchmark *b* and *b+1*, is written as:

$$\frac{r_{li} - r - Cmg_i}{r_{li}} = -\frac{S_i}{\varepsilon_l}\left[1 + \sum_{h=1}^{s}\left(\sum_{\substack{j \neq i \\ j \in h}} \frac{y_{1,j}}{y_{1,i}}\right)\left(pond_b CVE_{b,h} + pond_{b+1} CVE_{b+1,h}\right)\right]\left[1 - \frac{v_i}{r_{li}}\right] \qquad (2)$$

In Equations 1 and 2, r_{li} is the interest rate on loans granted by firm *i*; *r* is the inter-bank interest rate for three months of operations; Cmg_i is the marginal operating cost for firm *i*; S_i is the market share for firm *i*; ε_l is the price elasticity of the market aggregate loan demand; $y_{l,i}$ is the volume of loans (output) for firm *i*; $CV_{b,h} = \frac{\partial \ln \sum_{j \in h}^{j \neq i} y_{l,j}}{\partial y_{l,i}}$ is the semi-logarithmic conjectural variation for firm *i* with respect to the relative reaction of firms belonging to size-class *h;* $CVE_{b,h} = \frac{\partial \ln \sum_{j \in h}^{j \neq i} y_{l,j}}{\partial \ln y_{l,i}}$ is the conjectural variation defined by the conventional approach of elasticity (a logarithmic approach); and v_i is the service quality of firm *i*. Moreover, coefficients $pond_b$ and $pond_{b+1}$ are the weights, as determined by the output distances between firm *i* and the neighboring benchmark firms *b* and *b*+1, which, in this way, add up to 1. For the benchmark observations *(i = t)*, the weights are $pond_b = 1$ and $pond_{b+1} = 0$.

Equations 1 and 2 include marginal operating costs. To determine these operating costs, we use a translog function, which is common in the analysis of banking markets because it addresses both scale and scope economies in multiproduct firms. Given two inputs and two outputs, the operating cost function for firm *i* can be written as:

$$\ln C_i = \alpha_0 + \sum_{k=1}^{2}\alpha_k \ln y_{k,i} + \frac{1}{2}\sum_{k=1}^{2}\sum_{m=1}^{2}\alpha_{km} \ln y_{k,i} \ln y_{m,i} + \sum_{u=1}^{2}\beta_u \ln w_{u,i} + \sum_{k=1}^{2}\sum_{u=1}^{2}\delta_{ku} \ln y_{k,i} \ln w_{u,i} + \frac{1}{2}\sum_{u=1}^{2}\sum_{z=1}^{2}\beta_{uz} \ln w_{u,i} \ln w_{z,i} + \varepsilon_i\ , \qquad (3)$$

where C_i is the operating cost, *m* and *k* are the subindexes that respectively refer to loans and deposits (our two outputs), *u* and *z* are the subindexes that respectively refer to labor and physical capital (our two inputs), and ε is the error term. While it is not possible to predict the sign of the variables' coefficients in the translog cost function, certain conditions often must be met. Symmetry and linear homogeneity, for example, are required: $\sum_{u=1}^{2}\beta_u = 1$, $\sum_{z=1}^{2}\beta_{uz} = 0$, $\forall u = 1,\ 2$; $\sum_{u=1}^{2}\delta_{ku} = 0$, $\forall k = 1,\ 2$. In addition, we derive the following relationship between inputs, known as Shephard's lemma,

$$sh_{u,\,i} = \frac{\partial \ln C_i}{\partial \ln w_{u,\,i}} = \beta_u + \beta_{uz} \ln w_{z,i} + \sum_{k=1}^{2}\delta_{ku} \ln y_{k,\,i}$$

(4), where $sh_{u,i}$ is the share of input u over the operating costs for firm i. We estimate this equation jointly with Equation 3 (our operating cost function) to see if we can achieve better results. Consequently, the marginal operating cost function is given by:

$$Cmg_i = \frac{\partial C_i}{\partial y_{1,\,i}} = \frac{C_i}{y_{1,\,i}}\left(\alpha_1 + \sum_{j=1}^{2}\alpha_{1j} \ln y_{j,\,i} + \sum_{u=1}^{2}\delta_{1u} \ln w_{u,\,i}\right) \qquad (5)$$

Following Kim and Vale (2001), we empirically implement our model by estimating it in two stages. In the first stage, we estimate the operating cost function (Equation 3) jointly with the cost-share function (Equation 4) using a Full Information Maximum Likelihood (FIML) estimation. We then use the estimated parameters to express the marginal cost of lending for each bank *i* in Equation 5. In the second stage, we use these estimates of marginal costs as input for estimating our first-order conditions, namely, the semi-logarithmic (Equation 1) and the logarithmic (Equation 2) conditions. In terms of the second-stage explanatory variables, this study accounts for market share (S_i) endogeneity, which might be correlated with residual error terms in the first-order conditions. To control for such endogeneity problems, we explicitly specify the endogenous variable (S_i) equation that reflects strategic firm behavior and the joint estimation of the model using a nonlinear FIML estimation (Shugan, 2004).

Consequently, we specify and estimate a reduced form market share (S_i) equation that includes as explanatory variables some firm characteristics ($NATM_i$: number of ATMs; $ASSEMP_i$: ratio of assets to number of employees), economic characteristics (GDP_i: regional Gross Domestic Product of the provinces in which the firm operates), and market characteristics (*CR3*: industry concentration or the loans market share of the three largest firms; $MARKGR_i$: market growth rate in the provinces in which the firm is operating). The reduced-form market share equation (S_i) can be written as follows:

$$S_i = \lambda_0 + \lambda_1 \log(NATM_i) + \lambda_2 \log(ASSEMP_i) + \lambda_3 \log(GDP_i) + \lambda_4 \log(CR3) + \lambda_5 \log(MARKGR_i) \qquad (6)$$

To summarize, two equation systems, one semi-logarithmic and one logarithmic, synthesize the second stage wherein each system includes two equations: one for the first-order condition (the semi-logarithmic (Equation 1) and the logarithmic (Equation 2) specifications), and the other one for the reduced-form market share equation (Equation 6). We then choose the specification—either the semi-logarithmic or the logarithmic one—that best fits the data in terms of the R^2. Finally, to ascertain the degree of competition we expect to find, we consider the estimated value of the benchmark's conjectural variations. We assume that a positive value of the conjectural variation reflects competition between firms, while a negative value reflects collusion (both in reference to the Cournot situation). A positive parameter ($(\partial y_{1,j} / \partial y_{1,i}) > 0$) would indicate competitive activity, because bank *j*'s output makes bank *i*'s profit margin smaller than it would be under Cournot competition; we characterize this situation as one of 'competitive' output. Alternatively, a negative parameter would indicate that bank *i*'s profit margin is larger than it would be under Cournot competition; we characterize this situation as one of 'cooperative' output. Testing diverse null hypotheses on the estimated conjectural variations allows us to examine asymmetric rivalry within and between strategic groups (Hypotheses 1 and 2).

SAMPLE, DATA, AND VARIABLES

Strategic groups in the Spanish banking industry

The Spanish banking industry provides us with an interesting test case because its own history helps to explain how strategic groups have been defined according to the size of their member banks, taking into account that size promotes group behavior that, in turn, affects the performance of all group members similarly. These group-level effects can take several forms including switching costs and efficiency.

Two types of regulations have influenced the history of the Spanish banking industry (Gual, 1992): the regulation of prices and the regulation of geographical expansion. While the regulation of prices (interest rates) in the 1960s removed price competition, it induced the larger banks to compete through investing more in services and client proximity (through expanding their branch networks). In general, the regulation of prices promoted the proliferation of branches and the tendency of banks to agglomerate, which, based on location theory (the principle of differentiation of Hotelling, see Tirole, 1989), is a reasonable response—that is, the settling of prices incentivizes firms to open new branches where demand is greatest and to compete by increasing quality by opening even more branches. In this sense, the branch structure of the Spanish banking industry is the result of the rivalry generated in a context of regulated prices: the broadest branch networks belong to the largest firms, which can then provide their clients with the most comfortable service.

The regulation in the 1970s and 1980s of the Spanish banking industry's geographical expansion created a market wherein banks operate at either the national, regional, or local level. Although the limitations to geographical expansion applied only to savings banks (they were restricted to either regional or local markets; this restriction was lifted in 1988), these restrictions nonetheless created a banking sector in which all firms, banks (i.e.: private banks are limited companies) and savings banks (whether privately or publicly owned, they are non-profit making and serve the public interest), operate either nationally, regionally, or locally because the limitations placed on the geographical expansion of savings banks generated markets of a local or regional nature. In fact, the operation of some banks is fundamentally local or regional (Gual and Vives, 1991). The different nature and complexity of the regions wherein they compete and the larger or smaller presence of a banking entity in each territory causes the financial contexts and market structures of individual institutions to vary. Accordingly, large financial entities that have offices in numerous regions face a different competitive structure and socioeconomic reality than small entities operating in only one territory. Boeker (1991) finds that a company's size parallels its classification according to geographical spread; indeed, national entities are generally larger than those with a regional scope, which in turn are generally larger than local entities.

The 1980s also saw the concentration of the banking industry due to the following three factors: the banking crisis that occurred between 1978 and 1985, the freedom of geographical placement that savings banks have enjoyed since 1988, and the integrating effects of Spain's entry into the European

Community (EC) (nowadays European Union (EU)). First, the strong link between banks and industrial firms meant that oil-producing nations' imposition of big price increases, which created an economic crisis (of an industrial type) between 1973 and 1979, also generated the Spanish banking crisis of 1978–1985. This crisis ultimately increased the industry's concentration ratio; between 1980 and 1984, the number of banks decreased and bigger banks bought out the smaller banks.

Second, the freedom of geographical placement that Spanish savings banks have enjoyed since December 1988, has created, on the one hand, the expansion of large savings banks to the national level and, on the other, the defensive formation of small savings banks into geographical groups. The latter was achieved through an accelerated process of mergers and acquisitions involving primarily savings banks operating in the same markets. Third, Spain's membership in the CE also concentrated banking through additional mergers and acquisitions, which, in turn, affected rivalry. Therefore, banks underwent mergers and acquisitions at the end of the 1980s to increase the size of Spain's financial firms for the purpose of competing in the broader European market and preserving market power. These measures were undertaken because, while Spain's integration into the CE had not yet occurred, news of the imminent integration caused banks to take proactive measures. Here, we emphasize the mergers between some of the larger private banks (e.g., Banco de Bilbao and Banco de Vizcaya) and between some of the larger savings banks (e.g., La Caixa and Caixa de Barcelona). The desire to reach economies of scale and scope (to pursue efficiency) provides another explanation for such mergers (Gual and Vives, 1991). That is, large entities aimed to secure both market power and efficiency, both of which are group-level effects.

Finally, in the Spanish banking industry, the group-level effects that derive from market power (through switching costs) and dynamic efficiency can be explained as follows: the liberalization of pricing began in 1967 with the removal of maximum interest rates on deposits and minimum interest rates on loans. From that point on until the achievement of total liberalization in 1987, only the small and medium banks, all of which had limited branch networks, competed by offering bank accounts with high interest rates (low prices). At the same time, large banks and savings banks were able to maintain a broad client base by offering accounts with low interest rates (high prices) and free services and by reserving their (unadvertised) high interest-rate accounts for special clients only. Indeed, there seemed to be a tacit agreement among the large financial firms to avoid introducing high interest-rate accounts to the public and, thus, to avoid price competition that would ultimately increase the financial costs of their deposits.

This particular state of affairs, wherein large banks offered clients very low interest rates on their deposits, was highly profitable for the large financial firms. These banks were, in the words of Fudenberg and Tirole (1984), fat cats: their broad client base provided them with no incentive to aggressively seek out more deposits, for offering accounts with high interest rates would significantly increase the costs associated with all of their deposit products, and not just on new accounts, given that their existing clients would demand the same remuneration as new ones. In contrast, medium and small banks, which did offer accounts with high interest rates, acted as puppy dogs: they maintained their limited capacity for capturing deposits and then posed no great threat to the large banks (Gual and Vives, 1991). In sum, as stated in ‘Hypotheses’ section, large banks tend to collude because: i) high switching costs clients must pay to switch banks empower large banks to create a captive client base that is available for ‘squeezing’; and ii) the broad branch network large banks invest in allows them to keep a large and stable client base and to establish a reputation for solvency.

With switching costs and efficiency established, additional dynamic effects began to manifest. These effects were prompted by the complete liberalization of interest rates in 1987 and by a price war in 1989 as tacit agreements to set high prices (low interest rates) across markets began to break down after deregulation. In this new climate of deregulation, banks were incentivized to deviate from prior tacit agreements with other members of their group owing to advantages—such as attracting more deposits and thereby increasing profitability at the other banks' expense—associated with being the first to offer high–interest rate accounts. Switching costs further enhance these advantages because clients attracted by a good offer will tend to stay with the same bank, even when other banks offer the same product. Our fat cats now become top dogs, relinquishing their cooperative attitudes out of an unwillingness to lose a significant amount of market share (Gual and Vives, 1991). This represents a dynamic effect of switching costs. This expansion of larger entities' client base, however, can also reduce unitary costs by establishing economies of scale at the branch level, that is, increasing the number of accounts per branch while holding the number of branches steady. This constitutes a dynamic effect of efficiency at the group level.

In 1992, the price war began to subside as the fight to secure high market shares gave way to the benefit of building either entities that used efficiency to reduce profit margins or entities that used expansion to reduce unitary costs. At this point, as the cost of maintaining high interest rates (low prices) continued to rise (Gual and Vives, 1991), switching costs served to turn the larger, more aggressive banks (the top dogs), who had substantially increased their market share (Mas-Ruiz *et al.* 2005) during the price war, back into fat cats with incentives to moderate their aggressive behavior (tacitly collude) once more. This constitutes another dynamic effect of switching costs.

In brief, regulation/deregulation and institutional structure demonstrate that size, and specifically size relative to the overall size of the market, is a defining characteristic of the Spanish banking industry (Espitia et al 1991), which explains why some authors (e.g., Freixas 1996) have used size to identify three distinct strategic groups: large banks, which are national in scope and distinguished by their extensive branch networks; medium banks, which are regional in scope and have a significant presence in a few local markets; and smaller banks, which are to a greater or lesser extent functionally or geographically oriented toward a single local market (i.e., a Province) (Gual and Vives, 1991). The history of Spanish banking shows that switching costs and efficiency are group-level effects that manifest such that large banks can distinguish themselves from medium and small ones. Therefore, assuming the existence of strategic groups as defined by Dranove et al (1998), through group-level effects, our analysis of Spanish loans market supports their differentiation based on the size of their member banks.

Sample and variables.

Our sample comprises 47 savings banks and 53 banks, all of which were in operation between 1992 and 1994. In 1994, our sample constituted almost 90 percent of the Spanish private loans market. Because our sample includes almost every firm in the market, we are able to proceed with an effective analysis of the market structure. Although prices and controls on fees were liberalized in 1987, the effect of this deregulation on the loans market was delayed as a consequence of a set of economic policy measures (e.g., quantitative limits on the growth of the domestic loans granted by banks to firms and individuals) adopted by the government between 1989 and 1990 to control increasing domestic demand and to reduce inflation and the commercial deficit in compliance with the criteria Spain had to meet in order to join the European Union (Gual and Vives, 1991). These measures delayed competition in the loans market, and therefore, we focus our analysis on the loans market between 1992 and 1994. In fact, the liberalization of the prices began to have a real impact on the loans market in 1993, with the beginning of the 'mortgage war' (Freixas, 1996). Banco Santander launched a new product in the loans market with a significantly low interest rate. This move forced other banks to react quickly by offering similar products with low rates in order to capture customers from other banks.

Our variables fall into three main categories: i) Variable for delimiting the strategic groups: *Firm size*: defined as the total monetary value of loans issued at the end of 1994. Like other studies on the Spanish banking sector (e.g., Freixas, 1996; Mas-Ruiz and Ruiz-Moreno, 2011), we consider three size-defined strategic groups: large banks, medium banks, and small banks. To delimit each group, we identify a certain homogeneity in the scope of each group's markets—based on the parallelism between firm size and geographical spread (Boeker, 1991)—between 1992 and 1994. On this basis, we define large firms as firms with a national scope who loaned more than 2.5 billion pesetas, medium firms as firms with a regional scope who loaned between 400,000 million and 2.5 billion pesetas, and small firms as firms with a local scope who loaned less than 400,000 million pesetas. As a result, two firms of similar size may yet belong to different size classes because they have different geographical scopes. The first group (GI) comprises the seven largest firms and constitutes 53.19% of the loans market. The second group (GII) comprises 16 medium firms and constitutes 25.44% of the loans market. The third group (GIII) contains the 77 smallest firms and account for 21.37% of the loans market. Finally, the benchmark firms include the largest firm in each group (observations 1, 7, and 24 from GI, GII, and GIII, respectively) as well as the smallest firm in our sample (observation 100).

ii) Variables used in modeling the conjectural variations (Equations 1 and 2) and the operating cost function (Equations 3 and 4): r: the inter-bank interest rate for 3 months of operations. r_{li}: the interest rate for loans issued by bank i. We estimate the annual averages of each bank's loan interest rates based on ratios of loans revenues, including the ratio of fee income to the values of outstanding loans. $y_{1,i}$: the total monetary value of loans issued by bank i. It includes the sum of 'loans to entities' and 'loans to clients' reported on the balance sheet. $y_{2,i}$: the total value of deposits carried by bank i. It includes the sum of 'deposits from clients,' 'deposits represented by negotiable shares,' and 'other deposits' reported on the balance sheet. $w_{1,i}$: the price of labor (personnel costs / number of employees) of bank i. $w_{2,i}$: the price of capital (operating costs other than personnel costs / fixed assets) of bank i. C_i: the operating costs of bank i (price of inputs * quantity of inputs). t_{92}, t_{93}: two dummy variables for capturing the time effect. v_i: service quality. We use indirect measures of the banks' service quality. These measures are the number of employees per branch, which captures the quality of service bank employees offer to their customers, and the number of branches per km^2, which captures the quality of service a bank offers their customers in the geographical area in which it operates. These two variables reflect the characteristics of firm i, and in combination they represent the implicit interest rate paid by a customer who chooses this firm. Service quality is a linear function that depends on these dimensions.

iii) Variables used in market share function (Equation 6): $NATM_i$: number of ATMs of firm i. as an indirect indicator of technological expansion of firm i, which directly affects its operating costs. $ASSEMP_i$: ratio of assets to number of employees of firm i as the volume of assets managed by each employee of firm i. GDP_i: Regional Gross Domestic Product as an indicator of the economic activity in the market in which a bank operates, and is computed as a branch weighted average of GDP for regions in which bank *i* operates. *CR3*: the industry concentration ratio or the loans market share of the three largest firms. $MARKGR_i$: the market growth of the regions in which firm *i* operates as indicator of the demand for banking services and the annual population growth rate in a given province. It is computed as a branch weighted average of market growth rate for provinces in which bank *i* operates.

iv) Variable used in the measurement of firm performance: LI_i: the Lerner index of bank *i* in the loans market. It is measured as $((r_{li} - r - Cmg_i)/r_{li})$. We chose this variable because it is the relative margin most suited to analyzing the evolution of the competition, for two reasons: a) oligopolistic competition models determine an equilibrium relationship between this relative margin and the structural and competitive conditions of the market; and b) this relative margin is the best proxy for the social welfare loss suffered due to market power.

AEB (*Asociación Española de Banca*), CECA (*Confederación Española de Cajas de Ahorros*), INE (*Instituto Nacional de Estadística*), and Bank of Spain publish the information we require to elaborate on these variables. Table 1 summarizes the statistics for the variables listed above.

[INSERT TABLE 1 HERE]

RESULTS

To determine the marginal operating costs, we estimate the cost function (Equation 3) jointly with the specification of the Shephard's lemma (Equation 4). We find a high adjusted R^2 of 95 percent (see Table 2). The estimated marginal operating costs are 0.024, 0.022, and 0.022 for the first, second, and third years of the analyzed period, respectively, reflecting a decrease in marginal operating costs. This decrease has two main explanations (Carbó *et al.* 2009): i) improvements in the evaluation of loan risk, which can lower loan operating expenses; and ii) mortgage loans, which are cheaper to initiate and service and which make up a larger share of loan portfolios. The model also detects a cost difference across groups (F=629, $p<0.0001$): the marginal operating cost of GI (0.021) during the analyzed period is lower than those of GII and GIII (0.024 in both cases), a difference that probably derives from large firms' economies of scale and scope, which affect intra-group performance.

[INSERT TABLE 2 HERE]

Next, we estimate each of the two equation systems (semi-logarithmic and logarithmic), using the first-order conditions (Equations 1 and 2) and the reduced-form market share specification (Equation 6). To do so, we use the ratio of *total assets of banking system* to *GDP* as a proxy for the aggregate demand elasticity of the loans market (ε_l). After estimating the two equation systems, we select the semi-logarithmic specification (see Table 2) because of its better fit with the data. Regarding the estimation of the reduced-form market share equation, we find that the coefficients for the number of ATMs (λ_1), the assets per employees (λ_2), and the regional GDP (λ_3) are all positive and highly significant, which suggests, as expected, that an increase in these variables favors an increase in market share. Furthermore, because our results show both the coefficients and the levels of significance of the rivalry within and across groups GI, GII, and GIII we are able to better understand the competitive asymmetry at the level of strategic groups that Hypotheses 1 and 2 predict (see Graphs 1, 2, and 3).

[INSERT GRAPHS 1, 2, AND 3 HERE]

Regarding the rivalry within groups, our model detects an independent conduct or Nash equilibrium within groups GII ($CV_{7,II}$) and GIII ($CV_{24,III}$) (see Table 2). That is, none of the coefficients are significant, which suggests that the firms in these strategic groups do not expect to experience any reaction from the firms in their group. By contrast, our analysis detects a competitive conduct between the large firms (GI) of the Spanish banking system; $CV_{1,I}$ is positive and significant below the 5% level. Thus, a large firm that increases its output will expect to experience aggressive behavior from the other large firms. Taken together, these findings provide evidence of an asymmetrical rivalry within groups.

Regarding the rivalry between groups GI and GII, we find that while $CV_{1,II}$ is not significant, $CV_{7,I}$ is positive and significant below the 1% level, which suggests that the competitive interaction between the members of these groups is asymmetric. Given this strategic interaction pattern, the GI firms expect to experience no reaction (independent conduct) from the GII firms ($CV_{1,II}$). That is, when the GI firms increase their output, the GII firms will ignore this action in their own decision making process and take their GI rivals' actions as a given. In contrast, when the GII firms increase their output, they do expect to experience some retaliation from the GI firms ($CV_{7,I}$); that is, the GII firms anticipate competitive conduct from GI firms, which will likely take the form of the GI firms increasing their output in order to compete with the increased output of GII firms. As such, from the perspective of GII firms, the interaction pattern more closely resembles a competitive one than one based on the Nash equilibrium.

Regarding the rivalry between groups GI and GIII, we find that while $CV_{1,III}$ is not significant, $CV_{24,I}$ (or $CV_{100,I}$) is positive and significant below the 1% level, which suggests that the competitive interaction between the members of these groups is asymmetric. Thus, when the GI firms increase their output, they expect to experience no response (independent conduct; $CV_{1,III}$) from the GIII firms. When, on the other hand, the GIII firms increase their output, they expect to experience competitive conduct ($CV_{24,I}$ or $CV_{100,I}$) from the GI firms in the form of a strong defense of their market position. That is, the GI firms have a more aggressive attitude toward the GIII firms than vice versa. This finding, along with our findings on the interaction between the GI and GII firms, provides evidence of a clear pattern of competition on the part of the GI firms. That is, both GII and GIII firms characterize GI firms as competitive agents who will respond aggressively to every attack, no matter where the attack originates (see Graph 1: $VC_{i,I}$). Alternatively, the GI firms characterize the conduct of the small and medium firms as independent in the face of the large firms' increases in output.

Finally, the competitive interaction between GII and GIII is also asymmetric: $CV_{7,III}$ is not significant, while $CV_{24,II}$ (or $CV_{100,II}$) is negative and significant. Thus, the GIII firms, which specialize in local markets, expect GII firms to react to their increases in output in a cooperative way ($CV_{24,II}$ or $CV_{100,II}$), that is, the GIII firms expect the GII firms to react by decreasing their output of these loans. However, when GII firms increase their loans output, they expect GIII firms to respond with independent conduct ($CV_{7,III}$). Hence, GII firms expect that GIII firms will consider GII firms' actions as a given, with the GIII firms content to specialize in local, rather than regional, markets.

When we compare the various patterns of rivalry within and across groups, we find that large (GI) firms expect to experience strong reprisals from other firms in their group—indeed, at 3.40 the magnitude of $CV_{1,I}$ is the largest of all the coefficients—and expect no reaction from GII and GIII firms. Furthermore, GII and GIII firms expect to experience a small amount of retaliation from GI firms—the magnitudes of $CV_{7,I}$, $CV_{24,I}$, and $CV_{100,I}$, which are 1.28, 1.20, and 2.17, respectively, are all lower than that of $CV_{1,I}$—and expect no response from firms in their own group (GII [$CV_{7,II}$] or GIII [$CV_{24,III}$ or $CV_{100,III}$]). Indeed, this finding suggests that GI firms dominate the banking industry. Accordingly, we do not reject our hypotheses, which predict that asymmetric rivalry exists at the level of size-defined strategic groups and is of the dominant/fringe type, as described in H1 and H2.

One possible explanation for our findings for both intra- and inter-group rivalry is that firm size—whose group-level effects can take several forms including switching costs and efficiency—promotes group behavior. The dynamic effects of switching costs led to a new strategy of capturing a client base (Gual and Vives, 1991): after the deregulation of prices in the Spanish loans market, there was no place for the pacifist attitude of a fat cat and the attendant leader-follower asymmetric behavior, and large banks had to assume the aggressive attitude of a top dog and the attendant dominant-fringe asymmetric behavior, and thereby directly threaten the market share of other large banks as well as the market shares of the small and medium banks. This series of events constituted the so-called 'mortgage war' (Freixas, 1996). In the same way, the efficiency combined with switching costs in an oligopoly dynamics, may explain the asymmetrical rivalry of the dominant-fringe type in evidence within and between size-defined groups. If large firms, owing to their economies of scale, set lower prices than their smaller rivals do, any advantage a large firm enjoys could be augmented and the positive feedback dynamics (word-of-mouth communication) could result in that firm's complete dominance of the market. That is, switching costs create positive network effects (Beggs, 1989).

Regarding the parameters of service quality (see Table 2), we find that the intercept (ρ_0) and the coefficient on the number of employees per branch (ρ_1) are significant and positive, which means that the explicit and implicit interest rates, r_{li} and v_i, respectively, are substitutable. Thus, ρ_1 shows that the higher the number of employees per branch, the higher the quality of service those employees offer to borrowers. Based on this higher service quality, a bank could justify increasing its interest rate for loans and thereby obtain a higher margin. The positive ρ_0 captures elements that increase the firm's service quality and operating margin as a function of non-observable characteristics in the specification. The coefficient on branches per km^2 (ρ_2), however, is not significant. To sum up, the number of employees per branch and the attention those employees give to their customers is a greater determinant of service quality than is the size of the firm's branch network. Finally, the parameters of the dummy variables are significant and negative. That is, the mark-up ratio between 1992 and 1993 is narrower than in 1994 and, consequently, competition between firms is greater in that period.

CONCLUSIONS

We use a sample of firms operating in the Spanish loans market to examine whether the asymmetry of intra- and inter-group rivalry in an industry is systematic and predictable. Our hypotheses predict that the degree of rivalry—which is explained by firm size, wherein size promotes group-level effects such as switching costs and efficiency—will depend on whether the competitor is within the same group as the competing firm or in a different group. We test it by estimating the effect of group-level strategic interactions on firm performance. We find that the competitive interaction within and between strategic groups of banks is both asymmetric and of the dominant-fringe type. That is, large (GI) firms expect to experience strong reprisals from other firms in their group and no reaction from the medium (GII) and the small (GIII) firms. The GII and GIII firms, on the other hand, expect to experience a small amount of retaliation from GI firms and no reaction from firms in their own group (GII or GIII). Therefore, we find that during the period of deregulation, the GI firms were the dominant firms in Spain.

The implications for management are as follows: First, managers should analyze their competitive environment from the perspective of the firms both in their own and in other size-defined strategic groups. Large firms in a period of deregulation are to be characterized as competitive agents that will aggressively respond to every attack, regardless of where the attack originates (in their own or in a different group). Furthermore, while a given member of the group comprising large firms could perceive any firm, large or small, as a potentially significant rival, it is the other large firms in its group that constitute its primary target of attack and counterattack. Second, our findings have valuable practical applications. These results make it easier to analyze the impact of a choice, such as increasing output, on a rival and therefore to predict that rival's most likely response. The group-level effects that attend the size of a strategic group's member firms may provide a useful frame of reference. Thus, in a deregulated period, the dynamic effects of switching costs may lead to an optimal strategy of capturing a client base, where dominant firms behave as an implicit or explicit cartel *vis-à-vis* the other dominant firms, but as Stackelberg leaders *vis-à-vis* the fringe firms. That is, firms in the dominant group expect strong retaliation by firms in their own group, but accommodation by firms in the fringe group. Finally, following Chen *et al.* (1992), we find that a key question an initiator must answer is whether an action can be designed so as to avoid eliciting reaction from other firms. Thus, our results suggest that, in a deregulated market, the dynamic switching costs facilitate large firms to design a strategy (i.e., top dog, that incentives a dominant-fringe asymmetric conduct) that reduces the responses of the smaller firms, while the results obtained by Mas-Ruiz *et al.* (2005) in the period following the war for market share suggest that such switching costs allow smaller firms to design a strategy (i.e., puppy dog, which incentives a leader-follower asymmetric conduct) which avoids the reaction of larger firms (fat cats).

This paper has some limitations. First, out of our need to work with detailed information, mostly on costs and demand at the firm level, we use proxies for several non-available variables. Second, we assume that the multi-market effect (coined by Edwards [1955] as 'mutual forbearance') is absent. Its existence would require a more complex model. Third, to get a more realistic picture of the industry, we consider the simultaneous estimation of three equations in our model—costs, rivalry, and demand—to be a good option. That said, we estimate the model in two stages to reduce the large number of parameters that a simultaneous estimation would otherwise involve. Finally, Kim and Knittel (2004) illustrate that there can be severe biases in estimates of mark-up levels in marginal cost models using the conjectural variations framework. Although several studies support the empirical validity of this framework (e.g., Dockner, 1992), we agree with Kadiyali *et al.* (2001) that '…more research is needed to reassure us that conjectural variations approaches are effective in inferring the right competitive interaction or to highlight conditions under which the technique fails.'

Our paper has several implications for future research. First, although we analyze loans quantity competition as a function of service quality, another interesting approach would be to contrast our results with those obtained by analyzing this competitive interaction as a function of the number of branches. Second, while we analyze the competition in a single market in terms of patterns of asymmetric interaction within and between size-defined strategic groups, future research might apply this approach to multi-market competition. Third, it would be useful to analyze the impact that decisions such as introducing a new product, extending an existing product line, merging with a competitor, and so on, have in a regulated market (Kadiyali *et al.* 2001). Fourth, our results are specific to the Spanish loans market. Thus, it would be interesting to analyze other countries or industries in order to test the relevance of our oligopolistic model under similar deregulations of markets characterized by switching costs that vary with the client base. Fifth, it would be useful to test whether competition varies over time, by implementing fully structurally dynamic models of competition with a time-varying conduct parameter, taking as a reference the Markov-perfect Nash equilibrium (Pakes and McGuire, 1994), among others. Finally, modeling rivalry with a different number of groups would allow testing the robustness of our findings under a different size-definition of groups.

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Table 1. Sample descriptive statistics and correlations (standard error in parentheses)

Variable	Mean	Correlations													
		r_{li}	$y_{1,i}$	$y_{2,i}$	$w_{1,i}$	$w_{2,i}$	C_i	ρ_1	ρ_2	S_i	$NATM_i$	$ASSEMP_i$	GDP_i	CR3	$MARKGR_i$
r (inter-bank interest rate)	0.11 (0.02)	0.54	-0.03	-0.03	-0.27	-0.00	-0.02	0.02	-0.00	0.00	-0.02	-0.15	-0.06	0.01	-0.07
r_{li} (interest rate of loans of firm *i*)	0.15 (0.02)		-0.07	-0.03	-0.16	-0.11	-0.02	-0.11	-0.00	-0.06	0.00	-0.21	-0.02	0.03	-0.07
$y_{1,i}^{+}$ (quantity of loans of firm *i*)	523,932 (1,171,679)			0.95	0.12	-0.14	0.97	0.00	0.93	0.99	0.75	0.21	0.09	0.02	0.01
$y_{2,i}^{+}$ (quantity of deposits of firm *i*)	498,379 (982,819)				0.17	-0.19	0.96	-0.03	0.95	0.95	0.88	0.24	0.09	0.00	-0.00
$w_{1,i}^{+}$ (unitary price of labor of firm *i*)	5.9 (1.1)					-0.00	0.13	0.30	0.08	0.11	0.18	0.54	0.18	0.09	0.04
$w_{2,i}^{+}$ (unitary price of capital of firm *i*)	0.5 (0.3)						-0.15	0.18	-0.19	-0.14	-0.21	0.06	0.13	0.01	0.01
C_i^{+} (operating costs of firm *i*)	20,260 (39,932)							-0.00	0.97	0.98	0.78	0.18	0.08	0.01	0.00
ρ_1 (employees/branch$_i$ of firm *i*)	7.9 (5.6)								-0.07	0.00	-0.09	0.37	0.35	-0.02	0.00
ρ_2 (Branches/km^2 of firm *i*)	0.02 (0.01)									0.94	0.83	0.14	0.05	-0.00	-0.00
S_i (loans market share of firm *i*)	0.01 (0.02)										0.75	0.20	0.09	0.00	-0.00
$NATM_i$ (number of ATMs of firm *i*)	189.8 (403.2)											0.23	0.13	0.01	0.00
$ASSEMP_i$ (assets / employee of firm *i*)	330.8 (147.8)												0.22	0.02	-0.10
GDP_i^{+} (Regional GDP of firm *i*)	3,099,548 (2,404,458)													0.00	-0.06
CR3 (concentration of 3 largest firms)	0.3 (0.2)														0.56
$MARKGR_i$ (market growth of firm *i*)	0.01 (0.01)														

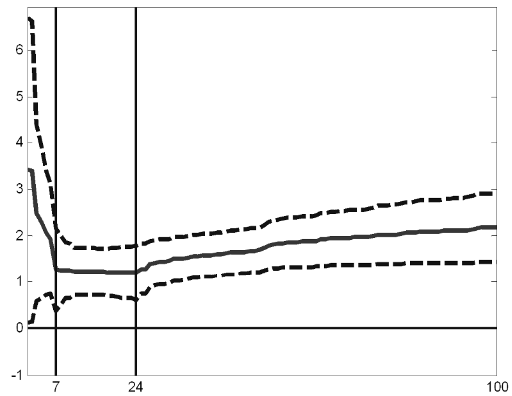
$^{+}$ in millions of pesetas

Table 2. Empirical results for the cost, market share, and competitive-behavior equations (standard error in parentheses)

Cost function		**Demand function**		**Competitive-behavior equation (first order condition)**					
Parameter	**Coefficient**	**Parameter**	**Coefficient**	**Intra-group CV**		**Inter-group CV**		**Service quality**	
α_0	-331.77^{***} (0.91)	λ_0 *(intercept)*	-0.16^{***} (0.05)	*Within group GI*		*Between groups GI and GII*		ρ_0 *(intercept)*	0.03^{*} (0.01)
α_1	0.41 (0.63)	λ_1 *(NATM)*	0.006^{***} (0.001)	$CV_{1,I}$	3.40^{**} (1.67)	$CV_{1,II}$	-3.86 (3.77)	ρ_1 *(emp/branch)*	0.0006^{**} (0.0002)
α_2	0.54 (0.63)	λ_2 $(ASSEMP_i)$	0.009^{**} (0.003)			$CV_{7,I}$	1.28^{***} (0.45)	ρ_2 *(branches/km^2)*	0.35 (0.29)
α_{12}	-0.09 (0.10)	λ_3 (GDP_i)	0.005^{**} (0.002)	*Within group GII*		*Between groups GII and GIII*		**Time Dummies**	
α_{11}	0.11 (0.15)	λ_4 *(CR3)*	-0.02 (0.03)	$CV_{7,II}$	1.38 (1.29)	$CV_{7,III}$	-1.46 (0.94)	Φ_1 (t_{92})	-0.05^{***} (0.003)
α_{22}	0.08 (0.06)	λ_5 $(MARKGR_i)$	0.002 (0.003)			$CV_{24,II}$	-1.72^{***} (0.59)	Φ_2 (t_{93})	-0.04^{***} (0.005)
δ_{11}	-0.006 (0.009)					$CV_{100,II}$	-4.67^{***} (1.31)		
δ_{21}	0.007 (0.008)			*Within group GIII*		*Between groups GI and GIII*			
β_1	0.557^{***} (0.03)			$CV_{24,III}$	-0.60 (0.45)	$CV_{1,III}$	-1.93 (3.27)		
β_{11}	0.015^{***} (0.005)			$CV_{100,III}$	0.50 (0.77)	$CV_{24,I}$	1.20^{***} (0.30)		
						$CV_{100,I}$	2.17^{***} (0.37)		
Cost equation	*Adj. R^2 0.95*	*Market share equation*	*Adj. R^2 0.33*	*Competitive-behavior equation*		Adj. *R^2 0.80*			

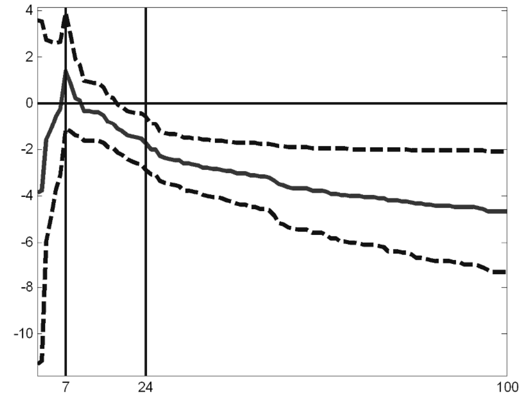
*** = prob. < 0.01; ** = prob. < 0.05; * = prob. < 0.10

Graph 1: Conjectural variations of group GI ($CV_{i,I}$)



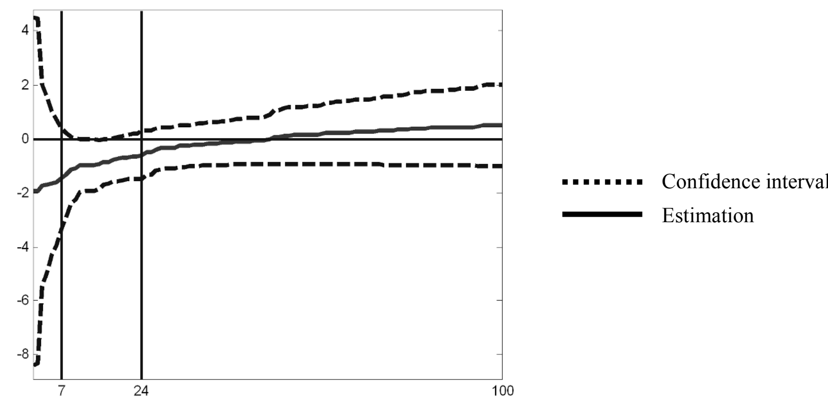
Financial firm *i*

Graph 2: Conjectural variations of group GII ($CV_{i,II}$)



Financial firm *i*

Graph 3: Conjectural variations of group GIII ($CV_{i,III}$)



Financial firm *i*