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THE DYNAMICS OF MULTIMARKET COMPETITION IN EXPLORATION AND EXPLOITATION ACTIVITIES

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Prior studies of multimarket contact have investigated "exploitation" rather than "exploration" activities. We contrast effects of multimarket contact on entry and exit dynamics in these two settings and propose that, although in exploitation, firms seek to optimize multimarket contact based on mutual forbearance benefits, in exploration, firms instead seek to reduce uncertainties through mimetic entry and exit. Analyses of biopharmaceutical firms' competitive dynamics from 1989 to 1999 support our model. We also find that multimarket contact in exploration leads to competitive entry and exit in exploitation, but not vice versa. We discuss implications for theory and practice.

"Multimarket contact" refers to the situation in which firms compete against each other simultaneously in several product and/or geographical markets (Gimeno, 1999; Karnani & Wernerfelt, 1985: 87; Korn & Baum, 1999: 171). Previous studies suggest that rivalries extending across multiple markets will lead to lower competition in an individual market—a situation known as "mutual forbearance"—because firms understand their interdependence enhances the risk of costly retaliation not only in the challenged market, but also in other markets in which they compete (Bernheim & Whinston, 1990; Fuentelsaz & Gomez, 2008; Gimeno & Woo, 1999; Greve, 2008; Haveman & Nonnemaker, 2000; Kalnins, 2004; Korn & Baum, 1999; Scott, 1982, 1991, 1993; Spagnolo, 1999; Stephan, Murmann, Boeker, & Goodman, 2003; Vonortas, 2000).

Previous theoretical and empirical research on multimarket contact (see Gimeno and Woo [1999]; Korn and Baum [1999] for reviews) has focused on "exploitation activities": that is, those that capitalize on fairly certain revenue streams, based on known parameters. The missing link in this literature has been the study of competitive behavior in "exploration activities": that is, those which entail searching for profitable opportunities in unknown and therefore highly uncertain environments (March, 1991). This gap is highly problematic, since most strategists subscribe to the idea that innovation and exploration are not only tantamount to interfirm competitive dynamics; they are also the underlying engine of industrial, strategic, and organizational competitiveness (Aldrich, 1999; Henderson & Clark, 1990; Porter, 1985). Schumpeter pointed that "new technology" drives the "perennial gale of creative destruction" (1950: 84), whereby technological change and innovation enable new players to challenge and threaten industry leaders (Evans & Schmalensee, 2001; Schmalensee, 2000). Porter also declared that "of all things that can change the rules of competition, technological change is among the most prominent" (1985: 164).

Given the dearth of systematic analysis of interfirm multimarket competitive behavior addressing exploitation and exploration simultaneously, it would be easy to assume that the same mutual forbearance logic applies similarly in these two contexts. In this study, we challenge this assumption and theoretically argue that firms follow different reasoning in these two domains, and as a result the competitive dynamic patterns differ for exploitation and exploration. We believe a practical example is best able to

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highlight our point. In exploitation, according to the mutual forbearance logic, any two hypothetical pharmaceutical firms (or firms in any other hypothetical industry) will refrain from stronger competitive aggression the more their markets overlap. The logic is that the gains from a competitive move in a given market (e.g., cancer treatment) may be worth less than the losses from price rivalry, market share fluctuations, and scale-related cost increases that will result from fierce retaliation in other markets where these firms also meet (e.g., Alzheimer's disease treatment or growth hormones). In a way, a larger multimarket contact frontier among rivals enhances the threat of costly retaliation and blunts the edge of rivalry (Edwards, 1955).

In exploration, on the other hand, this ability to outline the competitive outcomes is less straightforward. Suppose, for instance, that two competitors avidly research new drugs in hopes of possibly dominating particular markets in the future. Although their research investments overlap in some markets, such investments also occur independently in others. In such situations, the question we ask is, Would multimarket contact lead to the same behavioral changes in exploration as it does in exploitation? The question is valid because, with exploration, it is difficult to foretell whether either firm will (1) finally develop any new product after years of research, (2) discover a breakthrough product *ahead* of the other (3) develop a product that is comparatively more effective, or even (4) establish technology- and scale-effective production and distribution structures. As these unknowns represent enormous uncertainties about the value of those explorative positions and the shape of the future competitive landscape, we theorize that firms are unable to establish a clear mutual forbearance limit to their competitive moves and countermoves, thereby creating instead a multimarket competitive dynamics based on mimetic behavior.

To the literature we build upon, our study adds in significant ways. Previous research on exploitation activities has theorized about inverted U-shaped relationships between multimarket contact and entry (e.g., Baum & Korn, 1999; Haveman & Nonnemaker, 2000; Stephan & Boeker, 2001; Stephan et al., 2003) as well as exit behavior (e.g., Baum & Korn, 1999). These curvilinear relationships, as we review in more detail later, emphasize the logical arguments of *mutual forbearance* (e.g., at low multimarket contact, firms are more likely to enter a rival's markets to build retaliatory capabilities; as multimarket contact and retaliatory capabilities increase, the likelihood of further entry decreases). In comparison, we theorize that in exploration, firms' entries into and exits from rivals' markets are driven more by *mimetic behavior* than by mutual forbearance. The logic here is that firms seek for ways to reduce search uncertainties and costly strategic mistakes through herd behavior. As a result, we propose that multimarket contact and the likelihood of explorative entry and exit will tend to be respectively positive and negative (as opposed to inverted U-shaped, as in exploitation). In a way, our theoretical derivative underlying the distinct entry and exit patterns observed across exploration and exploitation is that in environments where change is more incremental and outcomes are predictable (i.e., exploitation), entry and exit multimarket moves neutralize rivalry, whereas in environments where change is more radical and outcomes unpredictable (i.e., exploration), these moves help firms reduce search uncertainties.

Additionally, because our study contrasts multimarket competitive dynamics across exploitation and exploration activities for the same population of firms, we are able to establish the extent to which competitive moves based on the mutual forbearance logic in exploitation drive competitive behavior in exploration; we are also able to determine the degree to which multimarket contact in exploration affects mutual forbearance behavior in exploitation. Our empirical analyses of biopharmaceutical firms' entry and exit behavior between 1989 and 1999 generally confirm our theory.

As we detail in the Discussion section, these findings help determine more precise boundaries for the mutual forbearance logic, while they also highlight the salience of mimetic behavior to understand firms' multimarket competitive dynamics.

BACKGROUND AND THEORY

For exploitation activities, we define entry and exit, respectively, as the events of starting and ceasing sales activities of existing products in a given market. For exploration activities, in contrast, we define entry and exit, respectively, as the events of investing in or divesting from research for a new-product technology that may or may not lead to a viable product in the future in a given market. In exploration, entry and exit do not involve multimarket competition through sales of existing products; instead, they involve multimarket research races for the prospects of premium (though highly uncertain) future profits.[1] To facilitate understanding throughout the article, at times we refer to *exploitative* entry and exit, as well as *explorative* entry and exit.

Examination of firms' entries and exits into and from rivals' markets is an important endeavor; such analyses "present several advantages over multimarket contact studies that look at market share stability, price-cost ratios, or profit margins" (Baum & Korn, 1999: 253). The success or failure of firms' strategies depends fundamentally on their interaction with competitors (Baum & Korn, 1999; Porter, 1980). In this regard, analyses of entry and exit behavior enable the direct examination of clear and visible competitive moves by rival firms (Baum & Korn, 1999: 253; Haveman & Nonnemaker, 2000: 236). For example, in exploitation, a firm may refrain from entering a rival's dominant markets to avoid retaliation in the firm's own dominant markets; likewise, firms avoid exiting markets they share with multimarket competitors so as not to lose their "cross footholds," which can be used for future retaliatory countermoves. In exploration activities, entry and exit moves can also be considered to be competitive acts. For example, at any given time, a firm may hold a portfolio of technology investments that could, each individually, potentially lead to a successful commercial product. The selection of items in this portfolio has both capability and competitive consequences; for example, a focal firm may avoid explorative entry into a rival's markets to avoid retaliatory entries of the rival into the firm's own markets, thereby diminishing the expected value of the focal firm's own investments.

Multimarket Contact in Exploitation vis-à-vis Exploration

Previous studies on multimarket contact and entry competitive behavior within exploitation activities have theorized a curvilinear, inverted U-shaped, relationship between the extent of multimarket contact between firms and the likelihood of competitive entry. The logic is as follows. At low levels of multimarket contact, firms are more likely to competitively enter rivals' markets so as to better signal their intentions (Baum & Korn, 1999; Greve, 2000), to build familiarity with their rivals' patterns of competitive behavior (Boeker et al., 1997; Jayachandran, Gimeno, & Varadarajan, 1999; Scott, 1993), and to acquire mutual footholds in their rivals' markets (Haveman & Nonnemaker, 2000; Karnani & Wernerfelt, 1985). As firms build up broader cross-foothold portfolios, they enhance their retaliatory and deterrence capabilities (Bernheim & Whinston, 1990; Jayachandran et al., 1999). For example, the larger the multimarket contact frontier, the more options firms have for retaliating by simultaneous attacks in several markets, and as such inflicting penalties that are more damaging than the original attack within a single market. Because of such implicit threats, firms enjoy a situation of mutual forbearance, whereby rivals implicitly agree to a lower grade of enmity (Edwards, 1955). As the multimarket frontier between two firms continues to grow, the likelihood of additional entry into each other's markets eventually declines. Such a decrease results from the fact that a deterrence effect, coupled with diminishing marginal returns per entry, begins to operate (Baum & Korn, 1999; Haveman & Nonnemaker, 2000; Stephan et al., 2003). Recent studies provide robust evidence linking multimarket contact and mutual forbearance behavior with organizational performance benefits, such as higher prices, margins, market share stability, and entry and exit; examples of such studies are Heggestad and Rhoades (1985), Scott (1991), Hughes and Oughton (1993), Parker and Roller (1997), Gimeno and Woo (1996, 1999), Evans and Kessides (1994), and Stephan et al. (2003).[2]

In contrast to the above, we reason that the mutual forbearance hypothesis should *not* apply to exploration activities. Instead, we expect that the association between multimarket contact and entry within exploration activities will be positive throughout the multimarket contact frontier, as opposed to inverted U-shaped. To begin with, since

[1] Multimarket competition has been considered not only at the product level (Huges & Oughton, 1993; Scott, 1982, 1991, 1993; Vonortas, 2000), but also at the geographical level in different industries, such as airlines (Evans & Kessides, 1994; Gimeno, 1999; Gimeno & Woo, 1996; Sandler, 1988; Singal, 1996), telephone equipment manufacturers (Barnett, 1993), cellular telephone service providers (Busse, 2000; Parker & Roller, 1997), cement manufacturers (Jans & Rosenbaum, 1997), hospitals (Boeker, Goodstein, Stephan, & Murmann, 1997), hotels (Fernandez & Marin, 1998), computer software (Young, Smith, & Simon, 2000) and banking (Alexander, 1985; Greve, 2000; Heggestad & Rhoades, 1978; Mester, 1987; Piloff, 1999; Rhoads & Heggestad, 1985; Whitehead, 1978).

[2] Though recent literature seems to fully support the curvilinear relationship established above, some earlier studies were in disagreement with the mutual forbearance theory, including Whitehead (1978), Rhoades and Heggestad (1978), Alexander (1985), Mester (1987), and Sandler (1988).

exploration activities are characterized by uncertainty in the result, investment decisions do not necessarily represent materialized competitive threats. Theories of bounded rationality (Cyert & March, 1963; Simon, 1947) predict that since it is difficult to estimate probabilities for expected value calculations in complex decisions, firms will tend to use heuristics and routines to resolve problems of complex uncertainty (Lieberman & Asaba, 1997). Thus, under conditions of bounded rationality, firms may not use expected values, and the use of heuristics may or may not be consistent with mutual forbearance. Further, firms may lack the organizational capability to formulate and implement a strategy of mutual forbearance (Li & Greenwood, 2004). Lastly, a path dependency in exploratory capability-building activities would make it difficult for firms to forego some future markets, particularly in the presence of uncertainty. Due to such path dependency, discontinuation of research activity in one domain may negatively affect other research in other domains over time. It is perhaps for these reasons that previous studies have tended to exclude exploration contexts from empirical analysis of multimarket contact.

Our premise is that instead of dealing with multimarket contact rivals in exploration similarly to those in exploitation—that is, through mutual forbearance competitive logic—firms will address the uncertainty in exploration by observing and imitating the entry and exit behavior of other, particularly similar, competitors (DiMaggio & Powell, 1983; Lieberman & Asaba, 1997; Tolbert & Zucker, 1983). Imitation, or herd behavior, particularly in contexts of high uncertainty, is motivated by the economics literature on oligopolistic theory (e.g., Knickerbocker, 1973; Tsurumi, 1976) and information cascades (e.g., Bikhchandani, Hirschleifer, & Welch, 1992), the sociological literature on institutional theories such as mimetic isomorphism (e.g., DiMaggio & Powell, 1983; Tolbert & Zucker, 1983), past patterns of behavior (Meyer & Rowan, 1977; Suchman, 1995), or simple strategic reasoning (Stephan & Boeker, 2001). Mimetic isomorphism logic argues that firms are more likely to imitate other firms that are easily observable and similar to themselves (Greve, 2000). Under greater uncertainty, firms tend to follow each other in their market activities, since a competitor's entry into an uncertain market may signal its attractiveness (Bikhchandani, Hirshleifer, & Welch, 1998; Lieberman & Asaba, 1997). Similarly, the past-behavior argument suggests that imitation arises from the fact that past informational cues narrow the range of uncertainty (Levitt & March, 1988), in which case multimarket rivals serve as models for each other when the outcomes of competitors' entry moves are uncertain. Strategic reasoning, in turn, explains that when contemplated actions have highly uncertain outcomes, the best strategy for a firm may be to imitate its rivals' actions so as to avoid eventually finding itself in a disadvantageous competitive position (Stephan & Boeker, 2001; Vernon, Wells, & Rangan, 1996). In this case, imitation is said to be highly rational, since the firm responds to signals from other firms that a given activity should be pursued (Abrahamson & Rosenkopft, 1993; Chen, 1996; Heinsz & Delios, 2001; Porac & Thomas, 1990); in exploration activities, instead of representing a competitive threat, competitors' investments represent a signal as to the commercial value of a certain technology. In sum, instead of forbearance, the most likely outcome of the competitive interaction under uncertainty is mimetic behavior, whereby rivals serve as models for each other.

The fundamental difference between our mimetic entry argument for exploration and the mutual forbearance logic for exploitation hinges on the existence of an inflection point in the growing likelihood of entry vis-à-vis multimarket contact levels. According to mutual forbearance theory, a firm finds an optimum point of multimarket contact, after which further entry offers diminishing returns and the likelihood of entry declines. In contrast, the mimetic entry logic is that, given the uncertainties in exploration, a firm is unable to find such a point of inflection. We thus expect that in contrast to the inverted U-shaped association between entry and multimarket contact seen under conditions of pursuing exploitation,

Hypothesis 1. In exploration, the relationship between the level of multimarket contact with a rival and the likelihood of a firm's entry into the rival's markets is positive.

Multimarket Contact and Exit in Exploitation vis-à-vis Exploration

The dynamics of multimarket competition involve not only entry but also exit decisions, since both these types of strategic moves alter the multimarket frontier (Barnett, 1993; Baum & Korn, 1999; Boeker et al., 1997). Yet the few existing studies of exit have also neglected exploration settings (e.g., Baum & Korn, 1996; Boeker et al., 1997; Lieberman, 1990); for example, studies of California airlines' exits from rivals' routes show that an airline's likelihood of exit from a competitor's markets was related in an inverted U-shaped manner to the level of multimarket contact of the airline with that competitor.[3] The logic of these studies' findings is simple. As multimarket contact rises from low levels, competitive interactions increase, given that rivals jockey for more competitive market positions vis-à-vis one another. Such rivalry intensification can push weaker firms to exit one another's markets (Baum & Korn, 1999: 256), resulting in an increasing likelihood of exit as multimarket contact grows from low to moderate levels. As the level of multimarket contact increases to even higher levels, however, the likelihood of market exit is likely to decline. Specifically, where a firm manages to build a large enough multimarket contact frontier, it will benefit from mutual forbearance in the form of greater stability in prices, rivalry, and market share (Baum & Korn, 1999; Karnani & Wernerfelt, 1985; Scott, 1993). Once cross-market footholds are established, the firm is unlikely to abandon them, since doing so would decrease the number of options for influencing its rival's behavior through credible deterrence. Thus, at higher levels of multimarket contact, exploitative exit decreases.

In contrast to the above, we expect that the association between multimarket contact and exit within exploration activities will be negative across the multimarket contact frontier—that is, the larger the multimarket contact, the less likely it is that a firm will exit a rival's market. Our logic is that in exploration, firms are less able to compute the outcomes of rivalrous moves and as such determine the value of competitive threats. Instead, exit moves will more likely follow the logic of imitation behavior (Bikhchandani et al., 1998; Lieberman & Asaba, 1997; Tolbert & Zucker, 1983). Through strategic reasoning, firms believe that when contemplated actions have highly uncertain outcomes, the best strategy may be to imitate rivals' actions so as to avoid eventually finding themselves in a disadvantageous competitive position (Vernon et al., 1996). Moreover, through social similarity reasoning, firms believe that imitation of similar firms (e.g., multimarket rivals) is a viable method for tackling uncertainty (DiMaggio & Powell, 1983; Greve, 2000; Meyer & Rowan, 1977; Pfeffer, Salancik, & Leblebici, 1976; Suchman, 1995). In markets where competitors meet with exploratory activities, rivals perceive each other's presence as a signal of the commercial value of that potential market and technology. In sum, just as firms rely on mimetic behavior to imitate their multimarket rivals' explorative entries, they also rely on the same logic to maintain explorative activities in rivals' markets. Put another way, the greater the multimarket frontier, the less likely a firm is to abandon explorative activities in its rivals' markets. Thus:

Hypothesis 2. In exploration, the relationship between the level of multimarket contact with a rival and the likelihood of a firm's exit from this rival's markets is negative.

Interestingly, the logic applied above also implies that when a firm's multimarket rivals exit a given market, the firm is likely to follow suit and exit the market as well.

METHODS

The Industry Context

We tested our theory through an empirical analysis of biopharmaceutical firms' entries into and exits from rivals' markets, within explorative and exploitative settings. The term "biopharmaceutical," as Rothaermel (2001) explained, describes the industry composed of traditional pharmaceutical companies that also have made investments in biotechnology for drug discovery and development. Therefore, our sample included pharmaceutical firms involved in both traditional chemistry (SIC 2834) and R&D in biotechnology (SIC 2836). Our unit of analysis is individual acts of entry and exit—that is, biopharmaceutical firms' explorative or exploitative entries into or exits from their respective rivals' markets.

We took the biotechnology R&D activities to be our explorative context and activities related to sales of existing products to be our exploitative context. This industry was appropriate for examining our research questions because of the technological and strategic evolutions it has been through. Biotechnology refers to a technique that comes from a specific scientific advance—the advent of molecular genetics and recombinant DNA. The emergence of modern biotechnology represents a technological discontinuity that has challenged the traditional pharmaceutical industry. As Shan, Walker, and Kogut (1994) indicated, biotechnology includes innovations that are foreign to established firms, whose technological tradition is built around traditional organic chemistry. In fact, recent studies have indicated that upstream value chain activities in drug R&D based on traditional chemical synthesis by pharmaceutical firms have been made largely obsolete within the new biotechnology model

[3] Boeker et al. (1997), studying a sample of 286 California hospitals, did not include a quadratic term in their model and found a simple negative and linear relationship between multimarket contact and the likelihood of exit.

(Lerner, 1997; Rothaermel, 2001; Vassolo, Anand, & Folta, 2004). For example, surveyed industry experts have estimated that the skill loss for a scientist making the transition from traditional chemical-based to biotechnology R&D lies between 80 percent and 100 percent (Rothaermel, 2001: 692). Such discontinuity helped us contrast competitive interactions in fairly stable circumstances (i.e., sales of existing products) with interactions in highly uncertain conditions (i.e., R&D of biotechnological products).[4] Despite all the uncertainty involved in biotech R&D activities, biotechnology products have been said to hold a promising future within pharmaceutical markets (Stuart, Hoang, & Hybels, 1999; Teitelman, 1989).

Data

We constructed a data set containing information about biopharmaceutical firms' explorative and exploitative entries into and exits from rivals' markets from 1989 through 1999 based on the following sources: BioScan, the biotechnology industry reporting service; the North Carolina Biotechnology Industry (NCBI); and the Physicians' Desk Reference (PDR). Initially, BioScan and the NCBI were used to identify a sample of large firms associated with biotechnology R&D investments. We identified 34 potential firms for the year 1989; however, due to intense mergers and acquisitions activity in the industry, our sample size decreased significantly to 19 firms by 1999. This industry consolidation is accounted for by modeling the firms separately until the merger or acquisition took place. Though firms had different national origins (e.g., the United States, England, France, Germany, Switzerland, and Sweden), they all sold products worldwide.

We next identified markets targeted by our sampled firms' R&D. BioScan captures R&D investment (and divestment) information by market, six times a year. This information enabled us to compute entry, exit, and multimarket contact for the explorative context. We did the same for exploitation using the PDR database. The PDR identifies markets in which firms sell existing products; using this information, we were able to compute entry, exit, and multimarket contact for the exploitative context. The market classification in the PDR and BioScan is simple and straightforward. Such classification replicates the Food and Drug Administration's (FDA's) "therapeutic class" taxonomy, whereby each market represents, and is named after, a therapeutic treatment, such as Alzheimer's-disease medications, antihypertensives, blood modifiers, ophthalmics, respiratory agents, skin rash treatment, antidandruff shampoo, and so on. It should also be noted that since by "markets" we refer to a therapeutic class, each market may include existing products as well as future potential products. Interviews conducted with industry executives, pharmacists, and hospital doctors and clinicians revealed that such market classification is referred to by all involved, raising our confidence in the relevance and validity of this market analysis scheme.[5]

The comparable market classification allowed us to identify entry and exit moves as explorative or exploitative, depending on whether they involved sales or R&D, rather than one or another particular market. For example, considering *all* industry firms, the PDR identified 278 markets in which firms conducted sales (exploitation) activities. Likewise, BioScan identified 143 markets in which firms conducted biotechnology R&D (exploration) activities. Because firms can conduct both exploration and exploitation activities within each market, one is not permitted labeling individual markets per se as "explorative" or "exploitative." Therefore, in our study, the term *exploitative entry*, for example, refers to a firm selling goods in a given market in which it did not sell before, rather than a firm entering a market prelabeled "exploitative." The same applies to the terms "exploitative exit" and "explorative entry and exit." Within the set of markets and nomenclature scheme defined above, the firms in our sample, on average, conducted exploitation activities in 31 markets per year throughout the 11-year period considered in our analysis. The largest of our firms conducted exploitation activities in as many as 58 markets, whereas the smallest, in as few as 12 markets. As far as entries and exits were concerned, on average, firms in our sample initiated exploitative activities in 6 new markets per year (for a total of 1,855 exploitative entries, considering all sampled firms, throughout the 11 years of activity analyzed; see Table 2). Moreover, firms in our sample initiated explorative activities

[4] On the basis of our analysis of company reports, we identified very few products representing biotechnological breakthroughs in exploitation. We computed regression models both with and without these biotechnology commercial products. We found no differences in the two analyses. The tables included in the next section report results without biotech commercial products.

[5] This market identification scheme has also been considered in previous research (e.g., Lerner, 1997; Rothaermel, 2001; Vassolo, Anand, & Folta, 2004).

in 10 new markets per year (for a total of 3,043 explorative entries, considering all sampled firms, throughout the 11 years of activity analyzed; see Table 2).[6]

Dependent Variables

As our hypotheses concern the determinants of explorative and exploitative entry and exit, we measured four dependent variables. From BioScan, we coded explorative entry as 1 if a firm began making R&D investments in a particular market between the beginning and the end of a given year, and 0 otherwise. Similarly, we coded explorative exit as 1 if the firm divested a research line between the beginning and the end of a given year, and 0 otherwise. We developed a similar coding scheme for exploitation. Drawing on the PDR data, we coded exploitative entry as 1 if the firm began selling products in a given market within a given year, and 0 otherwise. Similarly, exploitative exit equals 1 when firms ceased to sell drugs in a given market, and 0 otherwise.

Independent Variables

Several measures of multimarket contact exist (e.g., Baum & Korn, 1996; Evans & Kessides, 1994; Gimeno & Woo, 1996). Here, we followed the lead of Gimeno and Woo (1996: 300) and used a count measure of multimarket contact that sums the number of markets other than focal market *m* in which firms *i* and *j* also compete. The average multimarket contact measure is the average of multimarket contacts with all of firm *i*'s relevant competitors from market *m*. Depending on whether the analysis referred to exploration (R&D) or exploitation (sales) activities, we altered our computations accordingly. Thus, an instance of multimarket contact in exploration ($MMC_{explore}$) occurred, according to our definition, when firm *i*, an incumbent firm that was then researching new drugs in market *m*, and another firm, *j*, that also conducted research in that market *m* (and was thus characterized as a rival in exploration) also met in (i.e., both also conducted research and development activities in) market *n*. Likewise, an instance of multimarket contact in exploitation ($MMC_{exploit}$) occurred, according to our definition, when firm *i*, an incumbent firm that was then selling drugs in market *m,* and another firm, *j*, that also sold drugs in market *m* (and was thus characterized as a rival in exploitation) also met in (i.e., both also sold commercial products in) market *n*. We coded those respective instances as $MMC_{ij,\ mn,\ t} = 1$. From there, we computed $MMC_{exploit}$ and $MMC_{explore}$ of firm *i* with competitor *j*, which we defined as the sum of multimarket contacts over all markets outside market *m* through our generically defined mathematical expression:

$$MMC_{ij,\ m,\ t} = \sum_{n \neq m} MMC_{ij,\ mn,\ t}\,.$$

From here, we computed the average intensity of multimarket contact in exploration activities (*average* $MMC_{explore}$) and exploitation activities (*average* $MMC_{exploit}$), which we expressed generically as follows:

$$Average\ MMC = \frac{\sum_{j \neq i} MMC_{ij,\ m,\ t}}{total\ competitors_{imt}}\,.$$

Control Variables

Although we were interested in developing a parsimonious model, other factors may also have influenced firm entry and exit behavior; we thus included control variables to ensure that results were not unjustifiably influenced by such factors.

Firm characteristics. Larger firms have been known to be more likely to not only diversify into other product-markets, but also invest in innovation (e.g., Lerner, 1997); therefore, we controlled for firm size, measured as *total US$ pharmaceutical annual sales* at time $t - 1$. We gathered sales data from Compustat, Lexis-Nexis, Global Access, and the annual reports of sample firms. We used different sources for observations prior to 1991, especially for non-U.S. companies. Where English versions of the annual reports were not available, we obtained the originals in French and German. To correct for skewness, we used a logarithmic transformation. This variable is the same in both our exploration and exploitation models.

In order to assess a pharmaceutical firm's dominance and commitment to expansion and innovation, we used two other variables. Previous studies have used market share to determine dominance (Evans & Kessides, 1994; Gimeno & Woo, 1996). In our context, it was impractical to try to determine market share, given the multimarket nature of most of the products. Instead, we gauged the *number of*

[6] These entry rates indicate a very high product turnover in a firm's product portfolio. Although one would be tempted to conclude that the firm's portfolio would be completely renovated in just a few years, an executive we interviewed indicated this not to be the case. Instead, firms have a mix of *staple* and *trial* products in their portfolios; while some products are stable sources of strong cash flow for many years, others enter and leave the portfolio on a trial basis very frequently.

markets in which the firm was active (exploitation). Controlling for dominance enabled us to control for the firm's dedication to maintaining supremacy over larger portions of the market. We also controlled for *the number of explorative entries of firm* i *in other markets at* t − *1*. Controlling for commitment to expansion and innovation helped us isolate the main effects in our multimarket contact variables, especially in activities involved in biotechnology research and development. We found these variables useful because greater research investment and greater experience seem to indicate a higher commitment to innovation and competition (see Lerner, 1997; Rothaermel, 2001). Lastly, we controlled for prior performance through *ROA at* t − *1*. Our intent was to control for entry and exit decisions emanating from profitability levels in previous years.

Market characteristics. Intensity in rivalry may affect profitability (Reinganum, 1985) and, therefore, strategic behavior. As the mutual forbearance hypothesis predicts, strategic behavior would be altered by a reduction in competition, whereas the imitation hypothesis suggests that strategic behavior would be altered in the opposite direction—increased competition as firms imitate incumbents. Thus, we used a count variable, *density*, to control for the intensity of rivalry in both exploration and exploitation (Lerner, 1997). We calculated density as the sum of all incumbents in the focal market at $t - 1$. As did Haveman (1993), we included linear and quadratic terms. We also controlled for *cumulative market attractiveness*. Our intention was to gauge the potential value (i.e., attractiveness) of a focal market. Here, we summed the total number of pharmaceutical firms that entered into the focal market at $t - 1$. We expected that entries into a focal market would increase with its attractiveness. Similarly, to control for the potential value of the entire industry, we used the count variable *industry attractiveness*, which is the sum of all entries in every market at *t*. We discerned exploration from exploitation in computing the measures above.

Unobserved time effects. We used a set of ten dummy variables to control for unobserved fixed effects of each time period. Such time effects can include economy-wide factors, such as recession or growth periods and wars—factors that could influence the overall balance of supply and demand (Anand, 2004) and consequently affect the results of our study.

Integrated multimarket contact. We also controlled for the degree to which firms met in markets *both* in sales and R&D. Here, we integrated the average intensity of multimarket contact for both exploration *and* exploitation into a single measure, multimarket $\text{contact}_{\text{integrated}}$.

Analysis

Given the binary nature of our dependent variable, we analyzed the effect of multimarket contact on entry and exit through a conditional fixed-effects panel logit model.[7] An important advantage of panel models is that they incorporate cross-sectional as well as time-varying variables. Thus, panel models provide better understanding of the dynamics of competition than do some other discrete choice models.

RESULTS

Tables 1a and 1b present descriptive statistics and Pearson correlation coefficients for exploration and exploitation, respectively. Computations are based on standardized variables. Given the correlations among the several independent and control variables, we tested for the problem of multicollinearity—one that might affect the significance of the main parameters in the regressions—through variance–inflation-factor (VIF) computations. VIF values were generally low, although some were as high as 5.3. According to Neter, Kutner, Nachtschiem, and Wasserman (1996), this level of multicollinearity is higher than desired, but being below the (rule of thumb) threshold of 10, this multicollinearity may not be severe enough to cause concern. To ensure the validity of our results and that our interpretations were not threatened by such multicollinearity, we ran regression models with sets of controls that were least-related, and only then ran regressions with all controls included. As we discuss

[7] For comparative purposes, we also analyzed our data using a semiparametric hazard rate model (see Haveman & Nonnemaker, 2000), which was useful for understanding the time of entry and exit, since such strategic decisions occur in discrete time periods. We followed the Prentice and Gloeckler (1978) proportional hazard model for grouped data. Given that we did not know the distribution of the duration function, this semiparametric specification allowed for less restrictive assumptions than imposing a specific distribution. The effect of duration is represented with a parametric specification by including the logarithm of time and also by a nonparametric specification using dummy variables for each time interval (i.e., each year). Hazard rate models results, which fully corroborate our panel logit analyses findings, are not presented here for parsimony; however, they can be obtained from the authors upon request.

TABLE 1A
Descriptive Statistics and Pearson Correlation Coefficients for Exploration Contexts[a]

Variables	Mean	s.d.	1	2	3	4	5	6	7	8	9	10	11
1. Entry	6.3	5.9											
2. Exit	6.7	6.1	−.05†										
3. Size	8.9	0.7	−.09*	−.29									
4. Entry experience	6.3	6.7	.14**	−.03	−.06*								
5. Market experience	31.4	46.0	−.21***	.20***	.02	.36***							
6. Intensity of rivalry	3.4	1.5	−.23***	.06*	.14**	.12**	.15**						
7. Cumulative segment attractiveness	1.8	2.8	.15**	.24***	.11**	.15***	.14**	.16**					
8. Industry attractiveness	26.1	33.7	.22***	−.09*	−.24***	.11**	−.13***	−.23***	−.07**				
9. Prior performance	11.5	5.6	.06*	−.00	.00	.02	.03	.02	.00	.01			
10. Multimarket contact in exploration contexts	8.0	7.1	.29***	−.29***	.27***	.11**	.11**	.23***	.14**	−.15**	.02		
11. Multimarket contact in exploitation contexts	2.1	2.0	−.05†	−.08*	.33***	−.06*	.02	.06*	.08*	−.15**	.03	.21***	
12. Multimarket contact integrated	14.7	11.3	.01	.00	−.03	.04	.03	.01	.00	−.02	.03	.05†	.04

[a] Computations are based on standardized values. Means are nonstandardized.
† $p < .10$
* $p < .05$
** $p < .01$
*** $p < .001$

below, our results seem to be robust across these different models, a fact that make us confident in our analysis and interpretation.

Tables 2 and 3 contain the regression models for our entry and exit models, respectively. The "a" and "b" sections of those tables indicate exploration and exploitation activities, respectively. In all tables, we ran two models with subsets of controls and the main multimarket contact variables for comparison purposes (e.g., Table 2, models 1 and 2), and then we ran the model with all control variables included and the main multimarket contact variables excluded (Table 2, model 3). Only then did we run the models with all control and multimarket contact variables included, as the main variables were introduced individually in subsequent models (Table 2, models 4, 5, and 6). The regressions with least-related sets of controls, together with our main multimarket contact variables, allowed us to show the robustness of our

TABLE 1B
Descriptive Statistics and Pearson Correlation Coefficients for Exploitation Contexts[a]

Variables	Mean	s.d.	1	2	3	4	5	6	7	8	9	10	11
1. Entry	10.3	8.9											
2. Exit	3.7	3.2	.05†										
3. Size	8.9	0.7	−.05†	−.09*									
4. Entry experience	8.2	8.5	.05†	.09*	.25***								
5. Market experience	38.1	44.2	.11**	−.12**	.23***	.37***							
6. Intensity of rivalry	4.5	3.6	.7*	−.11**	.23***	.26***	.12*						
7. Cumulative segment attractiveness	3.1	4.5	.15**	.14**	.44***	.16**	.17**	.17**					
8. Industry attractiveness	57.7	58.1	−.05†	−.07*	.18**	.11**	.02*	.14**	.19**				
9. Prior performance	11.5	5.6	.01	−.05†	.00	.01	−.001	.01	.03	.04			
10. Multimarket contact in exploration contexts	8.0	7.1	.09*	−.11**	.20***	.15**	.21***	.19**	.19**	−.14**	.01		
11. Multimarket contact in exploitation contexts	2.1	2.0	.29***	−.29**	.23***	.19**	.17**	.20***	.11**	.12**	.00	.21***	
12. Multimarket contact integrated	14.7	11.3	.00	.00	−.02	.03	.03	.02	.02	−.01	.02	.04	.05†

[a] Computations are based on standardized values. Means are nonstandardized.
† $p < .10$
* $p < .05$
** $p < .01$
*** $p < .001$

TABLE 2
Results of Regression Analyses for Entry in Exploration and Exploitation Contexts[a]

Variables	(2A) Entry in Exploration Contexts[b]						(2B) Entry in Exploitation Contexts[c]					
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8	Model 9	Model 10	Model 11	Model 12
Size	−0.04	−0.03	−0.03	−0.04	−0.03	−0.04	−0.07*	−0.05†	−0.05†	−0.06†	−0.06*	−0.06*
	−0.25	0.26	0.25	0.27	0.25	−0.29	−0.04	−0.03	−0.04	−0.04	−0.04	−0.04
Entry experience	0.11**	0.13**	0.11**	0.09**	0.10**	0.08*	0.03	0.03	0.02	0.04	0.03	0.02
	0.12	0.11	0.10	0.11	0.10	0.11	0.13	0.13	0.13	0.13	0.13	0.13
Market experience		−0.19**	−0.21***	−0.20***	−0.19**	−0.18**		0.05†	0.06†	0.05†	0.05†	0.05†
		−0.13	−0.14	−0.14	−0.14	−0.14		0.01	0.03	0.04	0.03	0.03
Intensity of rivalry	−0.22***		−0.19***	−0.23***	−0.22***	−0.19***	0.05†		0.06†	0.05†	0.05†	0.05†
	−0.14		−0.14	−0.15	−0.15	−0.15	0.03		0.03	0.03	0.03	0.03
Intensity of rivalry squared	0.10*		0.09*	0.09*	0.08*	0.07*	0.11*		0.12**	0.10*	0.12**	0.12**
	0.12		0.13	0.13	0.11	0.12	0.08		0.08	0.08	0.07	0.07
Cumulative segment attractiveness		0.13**	0.11**	0.13**	0.13**	0.14**		0.15**	0.13**	0.13**	0.14**	0.14**
		0.15	0.17	0.17	0.17	0.17		0.06	0.07	0.07	0.07	0.07
Industry attractiveness		0.13**	0.16**	0.19***	0.17**	0.16**		−0.07*	−0.05†	−0.05†	−0.05*	−0.06*
		−0.10	0.15	0.16	0.15	0.14		−0.04	−0.06	−0.05	−0.06	−0.06
Prior performance		0.06*	0.05†	0.04	0.05†	0.05†		0.01	0.00	0.00	0.01	0.01
		0.02	0.01	0.01	0.01	0.01		0.02	0.02	0.02	0.02	0.02
Multimarket contact in exploitation contexts	−0.04	−0.04	−0.04	−0.03	−0.02	−0.04	0.26***	0.28***		0.28***	0.25***	0.24***
	−0.11	−0.10	−0.12	−0.12	−0.12	−0.12	0.10	0.12		0.11	0.10	0.10
Multimarket contact in exploration contexts	0.27***	0.26***		0.28***	0.27***	0.25***	0.08*	0.08*	0.07†	0.07†	0.08*	0.07†
	0.17	0.19		0.16	0.17	0.17	0.08	0.07	0.08	0.08	0.07	0.08
Multimarket contact$_{\text{explore}}$ squared	−0.12**	−0.13**			−0.12**	−0.13**						
	−0.06	−0.08			−0.08	−0.07						
Multimarket contact$_{\text{exploit}}$ squared							−0.14**	−0.12**			−0.12*	−0.14**
							−0.12	−0.11			−0.10	−0.10
Multimarket contact$_{\text{explore}}$ × multimarket contact$_{\text{exploit}}$	0.01	0.01				0.01	−0.04	−0.04				−0.03
	−0.22	−0.22				−0.22	−0.03	−0.03				−0.03
Multimarket contact$_{\text{integrated}}$			0.00	0.00	0.00	0.00			0.00	0.00	0.00	0.00
			0.12	0.13	0.12	0.11			0.10	0.11	0.11	0.09
Log-likelihood	−524.29	−510.63	−430.01	−404.51	−400.28	−399.77	−428.34	−417.82	−408.64	−406.63	−402.67	−402.07
Log-likelihood ratio test	66.57***	27.31***		51.02***	8.45**	1.03	20.20***	21.03***		8.07*	7.91*	1.19

[a] Standard errors appear beneath parameter estimates. Year dummies were included in the models but are omitted from the table for readability. In these models, independence of observation was assumed. In our computations, independence was violated by multiple decisions for each firm and the correlation among these decisions. This problem may not bias parameter estimates (Boeker et al., 1997) but can bias standard error estimates. To deal with this matter, we followed Huber-White sandwich estimates of variance; as such, we generate robust variance estimates (Williams, 2000).

[b] $n = 3{,}043$.

[c] $n = 1{,}855$.

† $p < .10$

* $p < .05$

** $p < .01$

*** $p < .001$

TABLE 3

Results of Regression Analyses for Exit in Exploration and Exploitation Contexts[a]

Variables	(3A) Exit in Exploration Contexts[b]						(3B) Exit in Exploitation Contexts[c]					
	Model 13	Model 14	Model 15	Model 16	Model 17	Model 18	Model 19	Model 20	Model 21	Model 22	Model 23	Model 24
Size	−0.28***	−0.28***	−0.27***	−0.25***	−0.25***	−0.24***	0.08*	−0.09*	−0.08*	−0.07*	−0.07*	−0.08*
	0.05	0.05	0.06	0.05	0.05	0.06	−0.06	−0.06	−0.05	−0.05	−0.05	−0.04
Entry experience	−0.03	−0.03	−0.03	−0.02	−0.02	−0.01		0.09*	0.09*	0.08*	0.09*	0.09*
	−0.09	−0.10	−0.08	−0.07	−0.04	−0.05		0.05	0.07	0.06	0.09	0.09
Market experience	0.19**		0.17**	0.15**	0.15**	0.16	−0.11**		−0.10*	−0.11**	−0.09*	0.09*
	0.02		0.02	0.02	0.02	0.04	−0.07		−0.04	−0.06	−0.05	−0.06
Intensity of rivalry		0.04	0.03	0.00	0.01	0.01		−0.10*	−0.11*	−0.10*	−0.10*	−0.09*
		0.02	0.04	0.02	0.02	0.03		−0.06	−0.04	−0.04	−0.05	−0.04
Intensity of rivalry squared		−0.07*	−0.07*	−0.02	−0.05†	−0.04		0.08*	0.08*	0.07*	0.07*	0.07*
		−0.03	−0.03	−0.03	−0.03	−0.02		0.08	0.07	0.06	0.07	0.06
Cumulative segment	0.22***		0.20***	0.23***	0.22***	0.19	0.14**		0.13**	0.13**	0.13**	0.13**
attractiveness	−0.05		−0.04	−0.03	−0.03	−0.03	0.08		0.09	0.07	0.07	0.07
Industry attractiveness	−0.08*		−0.07*	−0.05†	−0.05†	−0.05†	−0.07*		−0.07*	−0.05†	−0.05†	−0.05†
	−0.09		−0.08	−0.08	−0.07	−0.08	−0.06		−0.05	−0.01	−0.01	−0.03
Prior performance	−0.00		−0.00	−0.00	−0.00	−0.00	−0.05†		−0.04	−0.04	−0.04	−0.04
	−0.00		−0.00	−0.00	−0.00	−0.00	−0.01		−0.03	−0.02	−0.02	−0.02
Multimarket contact in	−0.07†	−0.08†	−0.08†	−0.08†	−0.06†	−0.06	−0.29**	−0.27**		−0.26**	−0.27**	−0.28***
exploitation contexts	−0.07	−0.06	−0.06	−0.07	−0.07	−0.07	−0.20	−0.19		−0.21	−0.21	−0.20
Multimarket contact in	−0.28***	−0.29***		−0.27***	−0.24***	−0.25***	−0.10*	−0.11*	0.09*	−0.09*	−0.09*	−0.11**
exploration contexts	−0.05	−0.07		−0.05	−0.04	−0.05	−0.09	−0.07	0.07	−0.06	−0.07	−0.06
Multimarket contact$_{explore}$ squared						0.05†						
						0.02						
Multimarket contact$_{exploit}$ squared												0.05†
												0.02
Multimarket contact$_{explore}$ ×	0.00	0.00			0.00	0.00	−0.04	−0.03			−0.03	−0.04
multimarket contact$_{exploit}$	−0.13	−0.13			−0.13	−0.13	−0.09	−0.10			−0.09	−0.08
Multimarket contact$_{integrated}$			0.00	0.00	0.00	0.00			0.00	0.00	0.00	0.00
			0.12	0.12	0.11	0.12			0.08	0.09	0.09	0.09
Log-likelihood	−232.28	−223.75	−220.69	−214.25	−214.23	−213.85	−430.48	−409.69	−413.33	−400.62	−398.47	−393.79
Log-likelihood ratio test	4.73†	17.06***		12.92***	0.04	0.76	44.12***	41.58***		25.42***	4.3*	9.36*

[a] Standard errors appear beneath parameter estimates. Year dummies were included in the models but are omitted from the table for readability. Our discussion in the Results section is based on the models presented in the right most column in each individual table segment (e.g., model 6 in Table 2a, model 18 in Table 3a, and so forth). The other models are regressions that include smaller subsets of variables. As an example, models 1 and 2 in Table 2a each have our main explanatory variable together with a subset of controls. Then, by specifying the other models with the complete set of controls (e.g. models 4, 5, and 6 in Table 2a), we demonstrate that the parameter estimates of interest are robust in all models, despite the presence of (minor) multicollinearity. The same modeling sequence applies to all other tables. Our choice of subsets of controls was based on the levels of multicollinearity observed; we chose those with highest levels. We also ran regressions with various other subsets and found results similar to those presented here. These can be obtained from the authors upon request.

[b] $n = 1{,}087$.

[c] $n = 1{,}983$.

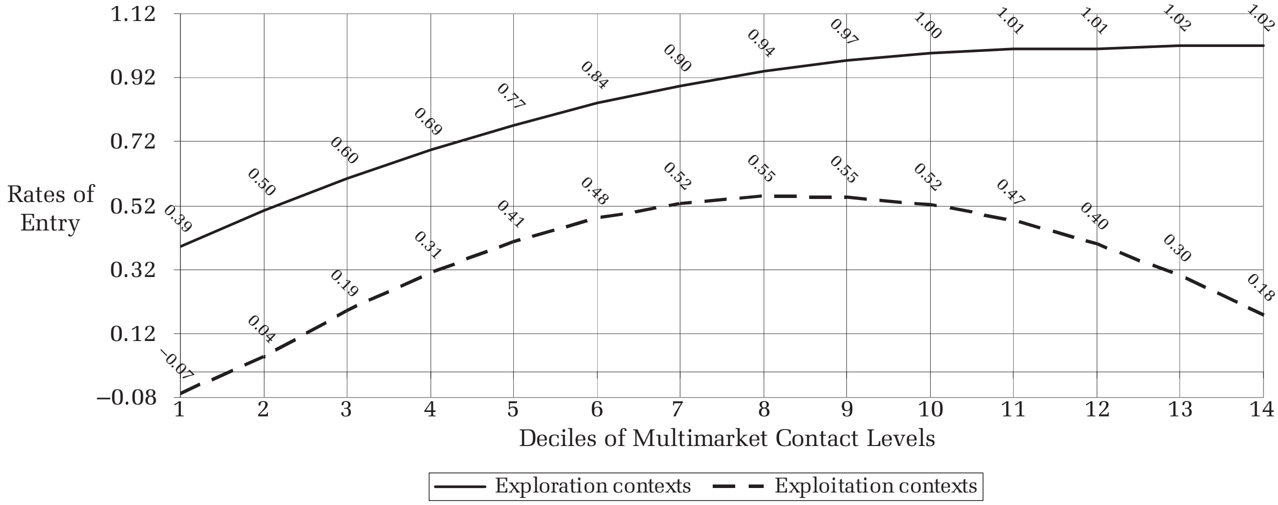
† $p < .10$

* $p < .05$

** $p < .01$

*** $p < .001$

FIGURE 1A
Comparing Entry in Exploration and Exploitation Contexts[a]



[a] The exploitation inflection point is between deciles 8 and 9; the exploration inflection point is in decile 15. As explained in the text, we graphed curves in Figure 1 beyond the 10th decile, up to *hypothetical* decile 14 to better contrast between the curvilinear rates of entry and exit in exploitation vis-à-vis the positive and negative respective rates of entry and exit in exploration.

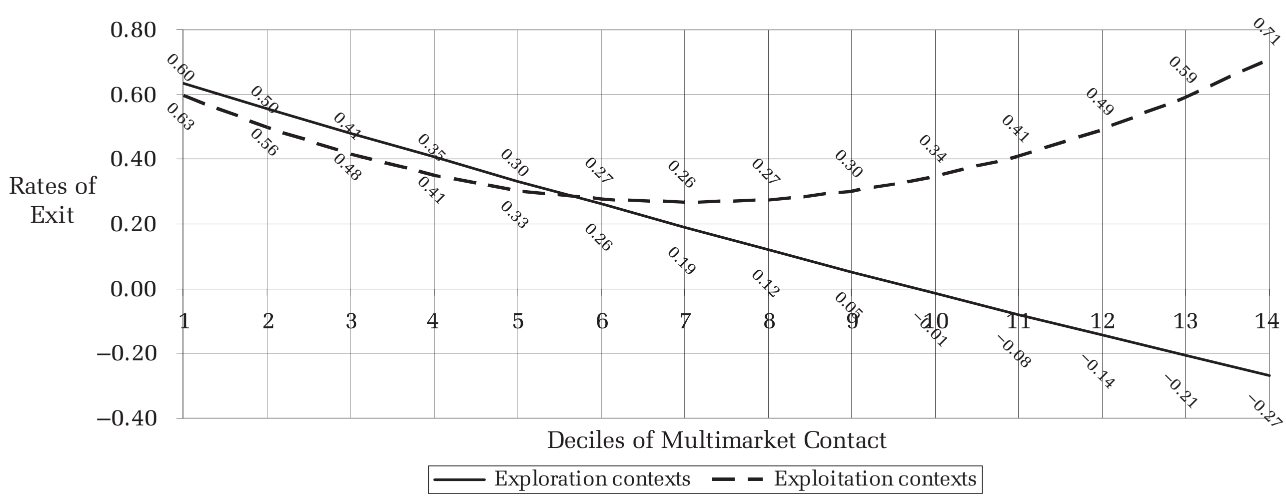
results, despite the presence of (mild) multicollinearity. All the other tables and model sequences follow the same pattern.

In Figure 1, we contrast entry and exit in the two types of activities (i.e., exploration and exploitation). The curves, which reflect the full models in Tables 2 and 3 (e.g., model 6), represent the likelihood of entry/exit for given deciles in the range of our data set. A feature of Figure 1 is that we plotted the models beyond the range of our data (i.e., beyond the limit of the 10th decile), into a 14th *hypothetical* decile; deciles obviously do not exist beyond 10, but this approach helps highlight the likelihood of competitive entry and exit behavior beyond the actual data set we analyze, as we explore in detail below.

Effects of Control Variables

Our control variables show mixed results. The logarithm of total sales, representing *firm size*, has unexpected negative values in exploitation entry and, as expected, negative values in exit models for both exploration and exploitation activities. Contrary to Haveman and Nonnemaker's (2000) find-

FIGURE 1B
Comparing Exit in Exploration and Exploitation Contexts[a]



[a] The exploitation inflection point is in decile 7; the exploration inflection point is undetermined.

ings, larger firms seem to be less likely to enter new exploitative activities, although they are neither less nor more likely to enter exploration activities. We believe this "odd" finding has two possible explanations. First, our sample was limited to very large pharmaceutical firms. Given possible equivalent corporate inertia observed throughout a sample of large firms only, we may have captured a homogeneous degree of corporate inertia; our firms may have been less able to nimbly follow through with multiple exploitative entries in several markets than could smaller firms. Second, firm size may simply be an irrelevant explanatory factor for multimarket explorative entry in our model. We believe our results could have been different, had our sample included a greater variance in firm size.

The *number of firm entries in other markets at* $t - 1$ had, as expected, a significant and positive effect for the explorative entry model and the exploitative exit models. Results confirm our expectation that more innovative firms seem to be not only more willing to enter exploratory activities, but also more likely to exit exploitative activities. The *number of markets a firm is currently in* had no effect on exit decisions; on the other hand, it had a significantly negative effect on *explorative entry* and a significantly positive effect on *exploitative entry*. The negative effect on explorative entry is surprising. This result could indicate that the larger the existing R&D portfolio of a given firm, the more likely the firm is to refrain from entering new R&D projects.

The variable *density* controlled for rivalry in markets. The expected coefficient for the variable regarding entry was negative, since an increase in the number of firms competing in a research race might have reduced the vigor with which firms pursued innovation. Values in section a of Table 2 confirm our expectations. Values in section b of this table, however, indicate that greater levels of rivalry in exploitation activities led to greater levels of entry. The squared terms, on the other hand, have just the opposite effect of the linear term. The difference between exploration and exploitation may exist because in exploration activities, firms may be less prone to trigger entry wars in new markets, since they are uncertain about the value of future technologies. This explanation is also corroborated by our findings in the respective exit models (Table 3). The values in the exit results are just the opposite of those found in entry models (i.e., positive, though insignificant) for explorative exit, and negative for exploitative exit. Density is thus an important control that captures isomorphic trends at the industry level, allowing the multimarket contact measure to better capture the pure competitive interaction between firms.

The variable *cumulative market attractiveness* (attractiveness of the focal markets) is significant for the entry and exit models in both exploration and exploitation activities. It seems that firms were more willing to enter attractive explorative domains and less willing to exit them. Finally, the variable *industry attractiveness* behaved as expected for explorative entry and exit (statistically significant, positive and negative coefficients, respectively), as well as exploitative exit (statistically significant, negative coefficient), but behaved opposite of what would be expected in exploitative entry (statistically significant, negative coefficient). We believe that pharmaceutical firms are both more willing to increase the scope of their explorative portfolios when the industry is more attractive and more reluctant to reduce the scope of their portfolios in such conditions. Nevertheless, the negative sign in exploitative entry seems to be at odds with received theory, according to which more attractive industries would impel pharmaceutical firms to enter them; however, it is possible that more attractive industries have higher barriers to entry. Lastly, except for exploitative entry, entry and exit decisions did not seem to associate with prior performance (ROA at $t - 1$).

Effects of Multimarket Contact

Hypothesis 1 predicts a *positive* relationship between multimarket contact and the likelihood of entry of multimarket rivals in *exploration* activities (as contrasted with an inverted U-shaped relationship in exploitation activities). Our interpretation of the results shown in Table 2 is that Hypothesis 1 is supported. Specifically, the linear coefficient of the multimarket contact variable in exploration activities (multimarket contact $_{\text{explore}}$) is positive ($\beta = 0.25$) and highly significant ($p < .001$). Meanwhile, the squared term is negative ($\beta = -0.13$) but also significant ($p < .01$). Though one would be tempted to interpret these results as indicating a curvilinear inverted U-shaped association between exploratory multimarket contact and the likelihood of multimarket firm entry, we delved deeper into the analysis. As we plot the data by deciles (Figure 1a), we see that the relationship between multimarket contact and the likelihood of entry of multimarket rivals does not have an inverted U-shape *within the data range of our population* (i.e., deciles 1 through 10). To be sure, we also plotted this association between explorative multimarket contact and entry into *hypothetical* deciles above 10, so as to gauge whether eventually it would curve down. We found that up to *hypothetical* decile 14—that is, well beyond the upper limit of data representing multimarket contact among our firms—the relationship is still monotonically positive (our computations show that entry eventually starts to decline at decile 15). Thus, though we have a significant, negative squared coefficient, we take the overall relationship as positive, since the inflection point occurs beyond the range of observable likelihood of entry. Our interpretation is consistent with the views of other scholars. For example, Shaver argued that "an author predicts an inverted U-shaped relationship, finds the coefficient estimate of the squared term is negative and significant, and concludes that they have support for their theory. Would it be of consequence that the curve inflects at a point well outside the range of data? I think it is inappropriate to conclude that a tail of this inverted U exists if no data are there to pull it down" (2006: 451).

Hypothesis 2 predicts a negative relationship between multimarket contact and explorative exit from given markets. Our interpretation is that Hypothesis 2 is supported. Specifically, model 18 of Table 3 shows that the coefficient of explorative multimarket contact is negative ($\beta = -0.25$) and significant ($p < .001$); at the same time, the squared term of multimarket contact is positive ($\beta = 0.05$) and marginally significant ($p < .1$). Although this combination of results may also indicate a U-shaped association, our plotting of the curve (Figure 1b) shows that the likelihood of multimarket exit from exploration activities is a monotonically decreasing function of multimarket contact within the range of our data. Thus, we are confident that the association between multimarket contact and the likelihood of explorative exit is negative (rather than U-shaped), as predicted, at least within the data range of our data and along hypothetical higher levels of multimarket contact. Further computations do not indicate the existence of an inflection point anywhere up to *hypothetical* decile 20. Regarding exploitative exit, although we had expected the association between multimarket contact and exploitative exit to have an inverted U-shaped relationship, as Baum and Korn (1999) found, we instead found that such an association follows a U-shaped pattern.

Here one could argue that the absence of inflection points within our data range (and also well beyond the upper-limit decile 10) in both our explorative entry and exit models may not mean that inflection points are not likely to exist at all. However, our findings at least allow us to infer that the inflection points in the likelihood of entry and exit in exploration occur at much higher levels of multimarket contact than do their exploitation context counterparts. Take the example of exploitative entry. Here, the linear coefficient of the multimarket contact variable (multimarket contact $_{\text{exploit}}$) is positive ($\beta = 0.24$) and significant ($p < .001$), whereas its squared term is negative ($\beta = -0.14$) and also significant ($p < .01$). A more refined analysis allows us to see that the inflection point occurs within the range of our data for entry (Figure 1a) as well as exit (Figure 1b). These results seem to confirm the findings of previous research on exploitation activities showing that as multimarket contact increases, the likelihood of the entry of multimarket rivals first increases, then decreases (e.g., Haveman & Nonnemaker, 2000). As such, for the matters of strategic behavior (i.e., entry and exit) associated with levels of multimarket contact, we take it that in exploration the association is indeed positive, as opposed to U- or inverted-U-shaped, as observed in exploitation. We conclude that *imitation* is a much more plausible competitive strategy for multimarket rivals in highly uncertain contexts than it is in less uncertain ones. Rivals seem to take *imitation* to much higher levels of multimarket contact in explorative activities than in exploitative ones.

Post Hoc Analysis: Interdependencies between Exploration and Exploitation

Our analysis rests on the assumption that managers handle competitive entry and exit decisions in exploitation activities independently from their entry and exit decisions in exploration activities. However, it is possible that competitive dynamics in explorative situations may be driven by multimarket contact in exploitative activities (and vice versa). For example, as a firm increases its explorative multimarket frontier with a rival, this rival may find that the future value of its R&D investments is threatened. As a result, this firm may retaliate by initiating sales in the dominant markets of the rival. Additionally, as hinted in the work of Galambos and Sturchio (1998), it is possible that several of the entry decisions made by pharmaceutical firms into the field of biotechnology were the result of herd behavior; that is, many firms avidly pursued biotechnology prospects because their multimarket rivals in exploitation markets did so.

To examine the possible interdependencies above, we further examine (1) the effect of exploitative multimarket contact on the likelihood of entry into and exit from markets in which rivals conduct exploration activities, (2) the effect of explorative multimarket contact on the likelihood of entry into and exit from markets in which rivals conduct exploitation activities, and (3) the effect of an integrated measure of explorative and exploitative multimarket contact on the likelihood of entry and exit for both exploration and exploitation. The three effects above are integrated into our regression models in Tables 2 and 3.

Results show that our integrated measure of multimarket contact across exploitation and exploration (multimarket $contact_{integrated}$) does not seem to significantly explain entry into nor exit from either domain. Moreover, multimarket $contact_{exploit}$ does not help explain entry and exit in exploration (i.e., multimarket contact in exploitation does not trigger entry or exit behavior in exploration). On the other hand, multimarket $contact_{explore}$ does seem to respectively associate positively (and significantly) with exploitative entry and negatively with exploitative exit. These results show an interesting degree of latitude in how firms manage entry and exit decisions vis-à-vis multimarket contact frontiers for exploration and exploitation domains. It appears that in response to a rival's continuing entry into markets in which a firm conducts exploration (i.e., the growth of multimarket $contact_{explore}$ between the two firms), a firm is likely to retort by initiating exploitation in markets in which the rival also conducts exploitation activities. We reason that this retaliatory behavior rests upon the usual mutual forbearance logic, as opposed to the mimetic behavior hypothesis. Specifically, exploitative entry (and exit) represent retaliatory actions with immediate consequences. Here, firms can credibly commit to rebuking a rival for "excessive" imitation in exploratory activities by establishing a multimarket retaliatory mechanism in exploitation domains. In sum, we conjecture the existence of an asymmetrical relationship between the dynamics of competitive rivalry in both exploitative and exploration domains. On the one hand, market entry and exit in exploitation domains seem to be governed by multimarket contact in both exploitation and exploration. On the other hand, entry into and exit from exploration domains seem to be governed only by multimarket contact in exploration, but not in exploitation.

DISCUSSION AND CONCLUSION

In this study, we contrast multimarket (entry and exit) competitive dynamics in exploitation and exploration activities. Previous research in exploitation has proposed inverted U-shaped relationships between multimarket contact and entry, as well as exit. Firms' competitive behaviors, the main logic goes, result from their logically optimizing multimarket contact levels to benefit from mutual forbearance (Baum & Korn, 1999; Karnani & Wernerfelt, 1985). Firms "enter" (i.e., they begin sales activities in) rivals markets in subsequent fashion up to the point at which their multimarket contact frontier is large enough to pose a credible threat of costly retaliation and firms refrain from further fierce competition. In contrast, we theorize that in exploration, firm entry and exit decisions will be driven much more by mimetic behavior, as opposed to mutual forbearance. Our logic is that the elevated levels of uncertainty in exploration hamper firms' abilities to rationally compute optimal equilibrium outcomes of competitive entry and exit dynamics. Thus, firms will rely on reproduction of multimarket rivals' entry and exit behavior, both of which are said to signal the possible future value of the market. Our empirical findings, based on the competitive behavior of firms in the biopharmaceutical industry between 1989 and 1999, generally confirm our theories.

Our research has significant implications for the literature on multimarket competition. The study of interfirm competition is central to strategy (Chen, Su, & Tsai, 2008: 101; Hitt, Ireland, & Hoskisson, 2005), but little has been done to unravel the dynamics of multimarket competition for both exploitation and exploration. This gap in the literature is highly problematic, given that strategists have agreed on the relevance of exploration to the dynamics of interfirm competition (Aldrich, 1999; Henderson & Clark, 1990; Porter, 1985). Our study helps address this gap. Specifically, exploitative entry and exit in multimarket competition settings have been modeled as "defect" decisions in prisoner's dilemma games. In such decisions, firms are said to determine the degree to which the gains from a competitive move could be overwhelmed by the costs of the move, where such costs could involve ferocious retaliation from other firms sharing the multimarket frontier. Our study supplements this perspective by demonstrating that under exploration scenarios—in which uncertainties are arguably higher vis-à-vis those in exploitation—firms have more difficulty in computing present values of future actions. Our research demonstrates that within more uncertain contexts, imitation becomes a more appropriate pattern of conduct. Here, rather than rationalizing an optimum level of retaliatory capabilities that affect entry and exit decisions vis-à-vis changing levels of multimarket contact, firms are much more attuned to reducing search costs, and as such, using rival's decisions as signals of the future value of particular markets. Although the argument of familiarity has been used to explain why firms increase multimarket contact levels within the context of mutual forbearance (Boeker et al., 1997), mimetic behavior becomes then a more reasonable theoretical underpinning for entry and exit behavior in exploration domains. Our empirical analyses confirm our reasoning. For *exploitation* activities, entry and exit decisions follow inverted U-shaped patterns vis-à-vis growing levels of multimarket contact; these findings generally corroborate the findings of previous research in the field. In contrast, in *exploration* activities, entry and exit decisions respectively follow a positive and negative association vis-à-vis growing levels of multimarket contact. Because managers were unable to find an optimum value of multimarket contact in exploration, we did not observe an inflection point in the rates of entry and exit, as they changed with growing levels of multimarket contact.

This study also expands our understanding of the strategic behavior dynamics of both exploration and exploitation. Our research design studies exploration and exploitation activities of the same population of firms and therefore enables us to contrast the rivalry dynamics and firm competitive behavior across these two domains. Our study highlights that whether firms compete in exploration or exploitation determines the degree to which rivals are able to find a mutual forbearance limit to their rivalry, as they build up a larger multimarket contact frontier. Our findings indicate that firms are unable to replicate the same mutual forbearance logic in exploration that is played out in exploitation. Moreover, based on the study of activities in these two domains for the same population of firms, we were able to gauge the degree to which multimarket contact in exploitation competitive entry and exit decisions holds true for multimarket contact in exploration (and vice versa.) Specifically, entry and exit decisions in exploitation domains respond not only to multimarket contact levels in exploitation itself, but also to those in exploration activities. It appears that higher multimarket contact levels in exploration often threaten the overall value of a firm's R&D investments. Reprisal against a multimarket rival, however, is hard to establish with retaliatory actions in explorative activities; this is because the value of multimarket rival's moves are hard to identify and assess. Given this limitation, penalizing one another is hard to do while in exploration. Rather, firms punish close rivals by further entering markets in which multimarket rivals conduct exploitation activities and castigation is typically more visible and has immediate consequences (e.g., by instigating a price war). On the other hand, however, increasing multimarket contact in exploitation does not help explain entry into and exit from exploration activities. Here, retaliatory capabilities in exploratory markets are greatly diminished by a firm's inability to inflict immediate losses on a rival. As a result, the alternative theoretical explanation—i.e., mimetic behavior—would apply in both domains. In sum, our study shows that firms manage the dynamics of multimarket competition in exploitative domains by taking into account multimarket frontiers in both exploitation and exploration. Such competitive dynamics can be explained by both the mutual forbearance and the mimetic behavior logics. However, these same firms manage the competitive dynamics in exploration domains based on multimarket contact levels only in exploration, but not in exploitation. This finding supports our conjecture that mimetic behavior in competitive dynamics is limitedly applicable to more uncertain contexts. As a result, our research helps establish more precise boundaries for multimarket competition theory as explained by the mutual forbearance hypothesis, yet it also enables us to put forth an alternative argument (i.e., mimetic behavior) for highly uncertain contexts. Establishing better delineated boundary conditions for theories is known to be an essential element in theory building (Dubin, 1978; Eisenhardt, 1989; Whetten, 1989).

Our model also helps us derive lessons for the imitation logic. Although previous literature has often pointed to the importance of uncertainty as a moderator of the effects of competitive interaction, we believe our study takes one step further by modeling and empirically testing competitive interaction behavior in environments characterized by higher and lower levels of uncertainty. Interestingly, given that firms in our study are the same in these two environments (i.e., we model how the same biopharmaceutical firms make strategic competitive decisions in both exploration and exploitation), we are able to more transparently contrast the strategic behavior in both environments. Lastly, previous studies on technology and innovation have generally relied on resource-based, knowledge-based, evolutionary, and dynamic capabilities perspectives. This focus on "internal" factors to understand how firms make decisions about innovation helps us better understand the issues involved in innovation but, we argue, should also be complemented by an equally important assessment of external factors. As our study demonstrates, innovation is indeed also influenced by external threats and competitive moves of opponents. We thus believe that our study also contributes to demonstrating this external focus, and as such helps balance the emphasis on internal factors involved in firm innovation and development.

Our study also brings significant implications for practice. It seems that where firms make competitive decisions based on rational computations of future market values in conventional exploitative environments, these same firms are well advised to take a different perspective on such behavior in exploration. Particularly, firms cannot simply transfer their mutual forbearance competitive rationales from exploitation into exploration. If a focal firm were to do so, it would disregard the high potential value of future sales in one particular disease segment simply for fear of nonexistent retaliatory potential from multimarket exploration rivals. However, where firms are jockeying for position based on highly uncertain environments, imitative moves seem to be more the pattern, and rivals are often more keen to follow their competitors' moves so as not to find themselves later at a strategic disadvantage.

Several limitations apply to our study. First, an important limitation is that our exploration context captures innovation that is more radical in nature (i.e., biotech R&D), to the exclusion of more incremental R&D (i.e., that involving traditional products and chemistry). As explained before, up to 80 percent (or even 100 percent) of R&D expertise within the firm can be scrapped when firms move from traditional chemistry R&D to biotech R&D (Anand, Oriani, & Vassolo, 2010; Rothaermel, 2001). Our primary interest is not in denying the explorative nature of traditional chemistry R&D; our interest instead is in better capturing the uncertainties conceptualized in March's (1991) exploration construct. This scenario would be the equivalent of Shell, Exxon, and British Petroleum competing on R&D for the prospects of alternative fuel technologies beyond petroleum, or Boeing and AirBus competing on new deeper space transportation technologies, beyond the airplane. We believe that further research will have to tackle whether the mimetic behavior said to hold for such highly uncertain exploratory activities would hold for more incremental R&D (i.e., innovation investments in areas where firms have more familiarity). We speculate that the lower levels of uncertainty involved in such incremental R&D would possibly result in firms demonstrating a mix of mutual forbearance and mimetic strategic behavior. Second, our study of multimarket competition is limited to firms' direct entry into given markets; further analysis is necessary to understand whether the effects found here also occur through strategic alliances. The importance of analyzing multimarket contact through alliances is large, given that many pharmaceutical firms invest in new product development by means of establishing alliances with smaller biotechnology firms (Anand et al., in press). Further, these alliances offer options for future commercialization of such products. We believe a real options approach would be useful to analyzing such effects (Vassolo et al., 2004). Lastly, further research will need to integrate better controls for the size of dominance in each particular market (e.g., Baum and Korn [1999] and Gimeno [1999] used measures of relative size for each multimarket competitor). Because firms do not engage in sales in exploration, nor do they report the size of their investments, we are still missing a measure of how serious explorative entries and exits were, vis-à-vis those of their multimarket competitors.

Understanding competitive dynamics in exploration has become a critical task in the rapidly changing technological environment. Overall, we believe that the efforts developed in the current article take researchers one more step closer to understanding the effect of multimarket contact on competitive behavior in exploration activities.

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