Competitive reaction to new products

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DOCTORAL DISSERTATION

Concurrentiële reactie op nieuwe producten

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Samenvatting

Innovatie is van kritisch belang voor het overleven van een bedrijf. Succesvolle bedrijven halen de helft van hun omzet uit nieuwe producten. Het is daarom duidelijk dat het belang van het succesvol introduceren van nieuwe producten niet kan overdreven worden. In hoeverre een bedrijf succesvol is op de markt hangt echter niet alleen af van hun eigen acties. Het is ook afhankelijk van hoe concurrenten reageren.


Een eerste studie is gebaseerd op data uit Nederland, de Verenigde Staten en het Verenigd Koninkrijk. De analyse toont aan dat twee derden van de nieuwe producten geconfronteerd worden met reactie van concurrenten. Prijs-reacties komen meest voor (43.6%), gevolgd door veranderingen in het productassortiment (35.5%). Concurrenten reageren in mindere mate op gebied van marketing-communicatie (23.9%). Reacties op gebied van distributie zijn zeldzaam (3.2%). Daartegenover staat dat innovatoren niet machteloos staan ten opzichte van het veroorzaken van reactie: de lanceringsstrategie die de innovator hanteert heeft een invloed op het al dan niet voorkomen van concurrentie reacties. Productlanceringen met de volgende karakteristieken krijgen meer te maken met concurrentiële reactie: (1) het product is een directe imitatie van bestaande producten, (2) het product is een significante innovatie binnen een bestaande productcategorie, (3) de lancering gebeurt met significante promotie-investeringen, (4) een selectieve targetingstrategie wordt gebruikt en (5) het product wordt gelanceerd in een groeiende markt.

Een tweede studie gaat dieper in waarom een concurrent reageert op een nieuw product. Dit gebeurt door de intermedierende variabelen tussen de productlancering en reactie te expliciteren.
De centrale these is dat reactie bepaalt wordt door hoe een concurrent een nieuw product beoordeelt. Deze beoordeling heeft betrekking op de motivatie en de mogelijkheid om te reageren. De motivationele component drukt de mate uit waarin een bedrijf de urgentie voelt om te reageren. De mogelijkheid-component drukt de mate uit waarin een bedrijf zich in staat voelt om te reageren. Het centrale construct van ‘interpretatie van een nieuw product’ wordt beschreven binnen een conceptueel kader. Dit conceptueel kader plaatst het in een mediërende rol tussen de productlancering en concurrentiële reactie.

Methodologisch onderscheidt deze studie zich van bestaand onderzoek dat gebaseerd is op retrospectieve weergaves van respondenten over hun reactie op nieuwe concurrentiële producten. De data-verzameling voor deze studie gebeurde in de context van een marktsimulatie. Dit stelt de onderzoeker in staat om de interpretatie van een nieuw product te registeren op het moment waarop de lancering gebeurt. De data-analyse combineert data van verschillende bronnen in een multi-level structureel model.

De resultaten demonstreren de mediërende rol van interpretatie van een nieuw product in de relatie tussen de productlancering en reactie. Zowel externe (in casu: de productlancering) als interne factoren beïnvloeden de interpretatie van een nieuw product. Het structureel model toont aan dat succesvolle bedrijven minder gemotiveerd zijn om te reageren op nieuwe producten. Dit staat tegenover het feit dat succesvolle bedrijven over een grotere mogelijkheid om te reageren beschikken.

Een derde studie voegt de tijdsdimensie toe aan het theoretisch kader. Deze studie onderzoekt wanneer bestaande bedrijven reageren op een radicale innovatie binnen hun industrie. Deze reactie wordt niet onafhankelijk beschouwd van de reactie van andere concurrenten. De centrale these in deze studie is dat een imitatie-effect bestaat: de reactie van andere bedrijven zet een bedrijf aan om ook te reageren. Specifiek wordt verondersteld dat vooral gelijkaardige bedrijven dit imitatie-effect oproepen. Steunende op de concurrentie-identificatie literatuur gaat dit uit van het idee dat bedrijven hun concurrentieel veld niet als homogeen beschouwen. Ze opereren op een mentaal model van de concurrentie-omeving dat concurrenten opdeelt in categorieën op basis van een aantal kritische dimensies. Bedrijven die behoren tot dezelfde groep worden verondersteld het meest invloed te hebben op de beslissingen van een onderneming.

De empirische context waarin het theoretisch model wordt getest is de Amerikaanse retail brokerage industrie. De resultaten tonen aan dat de reactie van een bedrijf op een innovatie niet onafhankelijk kan gezien worden van de reactie van andere bedrijven. Een bedrijf wordt meer geneigd om te reageren op het moment dat gelijkaardige bedrijven dat ook doen. Dit demonstreert dat een imitatie-effect bestaat in de reactie van verschillende bedrijven op een innovatie.
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CHAPTER 1
Introduction

1. BACKGROUND, MOTIVATION AND OBJECTIVE OF DISSERTATION

1.1. Introduction

This dissertation investigates the reaction of competitors to new products in the market. In today's rapidly evolving world, companies cannot subsist without innovation. Successful firms obtain up to 49% of their sales from new products (Griffin, 1997). But the impact of new products on the market depends on the competitive play that results from it. The leniency that innovators receive from competitors benefits their performance and profitability. Likewise, competitors need to decide on an appropriate response. Given the fact that new products by definition change the competitive landscape and create uncertainty, this is not straightforward. Recognizing the potential of innovations is often a difficult task. In 1977, Ken Olsen, president and founder of Digital Equipment Corporation said: "There is no reason anyone would want a computer in their home". And even today, at a time there is general agreement about the critical importance of technology and innovation, companies struggle to recognize revolution. In 1997, Merrill Lynch's vice-chairman John Steffens called online brokerage a serious threat to American's financial lives. Today, there are 27 million online brokerage accounts in the US, representing 1.7 billion dollar in assets, and Merrill Lynch has followed suit.
Clearly, when an industry is confronted with new products, the optimal competitive behavior is not the result of a simple optimization equation. Innovations often change industry boundaries, and cannot easily be evaluated within existing dimensional frameworks. New products can create a great deal of uncertainty within the market. This uncertainty may be grounded within questions about the target market of the new product, potential performance, technological evolution etc. Given this ambiguity, a lot of questions arise about the way companies deal with new products.

1.2. Overview

This dissertation contains three empirical studies that address different research questions that relate to the response of competitors to the emergence of new products within their industry. The first study examines the likelihood and nature of competitive reaction to competitive new product introductions. In particular, it examines how the new product launch strategy influences the reaction of competitors. The second study zooms in on the decision-making process that leads to competitive reaction. This study establishes the mediating role that new product assessment by the competitor plays between the new product introduction itself and the subsequent competitive reaction. Finally, the third study investigates the speed at which incumbents respond to a radical innovation within their industry.

1.3. Objective

The three papers in this dissertation may at first glance appear quite different. They tackle different research questions and employ different data, different empirical settings and different methodologies. Content-wise, each chapter deals with the reaction of competitors to product innovation. This issue is not the single relationship between them. Although at first sight each study may seem different, they share a number of recurring themes. The objective of this chapter is to depict the common theoretical background. The different chapters of this dissertation are self-contained papers. Each includes research objectives, theoretical backgrounds and literature reviews that are specific to the subject of the paper. Nonetheless, it is important to define the overall objective of this dissertation and how it is represented in each paper.

This dissertation maintains that one of the major shortcomings of the existing literature on competitive reaction to new products is that is does not enough recognize heterogeneity across firms. Appendix 1.1 contains an overview of the results from published empirical studies. Remarkably absent from the extant knowledge is extensive insight in the influence of the companies' characteristics on its reaction to innovations. Most existing literature fits within an industrial organization theoretical background. It posits that industry characteristics and market positions determine competition between firms. The first paper in this dissertation fits within this perspective. In the following two papers, I extend the theorizing
to include organizational factors by considering two hitherto neglected perspectives. First, building on a resource-based perspective, I hypothesize that companies respond differently to innovations because of their different resource position. Second, I add a behavioral perspective as a causal factor of heterogeneity between firms. Throughout this dissertation, the deliberate approach is to incorporate behavioral perspectives into quantitative empirical models of competitive behavior.

The approach behind the studies presented in this dissertation is based on the belief that it is useful to study the behavior of firms. The value of this lies in helping us identify the general principles behind why firms behave as they do. Developing a better insight in the reaction behavior of companies to new products has useful implications for both the innovating and responding companies. On the one hand, it helps innovating companies to better assess the competitive response to be expected. This information contains important input for the development of an effective introduction strategy. On the other hand, it makes reacting companies aware of their own behavior and can help them to better organize for an effective competitive line of attack and defense.

1.4. Motivation

This dissertation adds to the increasing field of literature within the marketing area that focuses on competition issues. The marketing concept is built on the belief that companies that are better equipped to answer market requirements and stay close to the customer enjoy superior performance (Day, 1994). In line with this customer focus, the dominant research tradition in the marketing literature addresses the link between a company and its customers (Weitz, 1985). The majority of papers published in the leading marketing journals deal with customer behavior and the resulting implications for the company's conduct. However, at the heart of the marketing concept is a dual orientation towards both customers and competitors (Kohli and Jaworski, 1990). Market-oriented companies actively scan their environment and reorient their market behavior in order to integrate market evolutions. Learning and responding to information about consumers as well as competitors constitutes an important capability that will result in better performance (Day, 1994; Hunt and Morgan, 1995; Li and Calantone, 1998). The effectiveness of marketing programs depends not only on the reaction of customers, but also on the reaction of competitors. The latter becomes ever more important in a world characterized by deregulated markets, global and concentrated competition and technological turbulence.

Recognizing this, research that addresses competition issues assumes increasing importance in the marketing literature. This is illustrated by the organization of the Competitive Responsiveness Conference by the Marketing Science Institute, the leading academic research organization in the marketing field. In this May 2001 conference, 34 papers were presented that discuss a myriad of different
research questions concerning competitive market behavior. The International Journal of Research in Marketing also devoted a special issue to Competition and Marketing in 2001.

1.5. Theoretical foundations

Upon inspection of these most recent developments of research on competition in marketing, it becomes immediately clear that they do not stem from a common research paradigm. *The objective of this chapter is to sketch existing theoretical foundations to the study of competition and to position the research presented in this dissertation within this landscape.*

In doing so, this chapter takes a step back from the specific research questions addressed in the different studies presented in this dissertation. The aim is not to provide a comprehensive literature review, nor to highlight deficiencies in the literature that are addressed through this dissertation. The three studies presented in Chapter 2, 3 and 4 each contain a separate literature review that is specifically tailored to the research issue each chapter deals with. Rather, this chapter takes a higher level of generalization, intended to sketch the broader theoretical views underlying the research of competition in marketing.

Existing research traditions that look at competitive responsiveness generally can be categorized within four research paradigms. There is a rich tradition of empirical research that fits within an industrial organization framework. Secondly, advances in game theory have led to an increasing amount of theoretical work on competition between firms. In the following discussion of the fundamentals of these two approaches it will be clarified that these both depart from the assumption that a company's competitive behavior is mainly determined by its competitive environment. This implies that different companies would by and large respond similarly to the same situation. This vision has been challenged by theories that emphasize the heterogeneity between firms. The resource-based view of the firm emphasizes that heterogeneity stems from the different resources firms have access to. The behavioral theory of the firm emphasizes that heterogeneity stems from a different cognitive assessment of the competitive situation.

In the following discussion, it is important to recognize that the theories that I address are not limited to the subject of competitive reaction to new products. They fit into a broader perspective of different paradigms to approach the issue of competitive behavior. Also, the different paradigms are not necessarily antagonistic views. Rather, they can complement each other by emphasizing different issues that drive competitive behavior (Amit and Schoemaker, 1993).
2. INDUSTRIAL ORGANIZATION ECONOMICS AND POSITIONING SCHOOL

2.1. Fundamental Principles

The basic concept of competition employed in industrial organization economics is that returns to the firm are determined by the structure of the industry, more than by the firm itself. The relationship between the structural characteristics of the industry and firm performance is known as the structure-conduct-performance paradigm. The structure-conduct-performance-paradigm states that industry structure drives company conduct, which in turn drives industry performance. This means that the firm needs to understand the nature of the industry in which it competes to formulate successful strategies.

The role of the manager is quite limited. Because firm conduct is controlled by industry structure, firm behavior is deterministic and only a limited influence is up to the manager's discretion. Industry structure plays a central role in determining and limiting strategic action. The main task of a company is to seek a defensible position in an attractive market and to keep competition off by strategic commitments, and signaling and pricing strategies.

Porter (1980) applies industrial organization principles to the field of business strategy. He presents a convenient framework for exploring the factors that affect the profits in an industry. It utilizes the structure-conduct-performance paradigm to develop normative guidelines for a company to optimally benefit from the structural characteristics of its industry. Following Bain (1956), entry barriers receive considerable attention as a key characteristic of an industry that shield it from competition. The company can exploit entry barriers to its advantage to deter potential new entrants (Gruca and Sudharshan, 1995). Additionally, the development of different strategy types introduces the idea that companies can gain a competitive advantage by selecting a position within an industry. Consequently, this positioning framework implies that competitive behavior will be determined by companies' relative positioning.

2.2. Industrial organization economics and competitive responsiveness to innovation

There is a rich tradition of empirical research in marketing strategy that examines the structural characteristics of a market and its influence on competitive responsiveness (Robinson, 1988; Ramaswamy et al., 1994; See also Appendix 1.3). Consistent with the theoretical perspective of empirical industrial organization and the positioning school, the emphasis of this research lies in finding the relationships between the structural characteristics of the industry and firms' positioning and the competitive behavior and performance of firms within the industry. This departs from the idea that firms share commonalities in their competitive behavior, that can be described by looking at their industry position. Studies looking at the reaction of competitors to their competitors' moves assume that the likelihood and nature of
competitive reaction stems from the structural characteristics of the market and the competitive position of firms. The prevalent method used in this research consists of the analysis of cross-sectional data to find empirical regularities across industries. Because data are pooled across industries, the results do not provide insight, or take into account, heterogeneity within markets (Kadiyali et al., 2001).

3. GAME THEORY

3.1. Fundamental Principles

Beginning in the late seventies, advances in game theory have led to a proliferation of analytical research that studies competitive behavior of firms within specific competitive settings (Eliashberg and Chatterjee, 1985; Moorthy, 1988). This strategic conflict research explores the effect of specific cost and demand structures of firms and their impact on their strategic actions. It thus introduces differences between firms that are absent from the empirical industrial organization literature. Particularly, the game-theoretic literature departs from describing competition as an amorphous and homogenous given, but explicitly specifies markets composed of interdependent firms: the actions of each firm affect the actions of other firms. The dominant notion is that performance is the result of clever moves and countermoves between competitors. Game-theoretic models rely on a set of assumptions about the behavior of competing firms and the information available to them. Based on these assumptions, the equilibrium strategy is derived analytically. This is based on an optimization of the chosen firm outcome (e.g. profit, share) through the relevant decision variable (e.g. price, advertising level, entry time, etc.). The decision-maker's role is assumed to be that of a rational actor who operates as a highly sophisticated information-processor that makes accurate conjectures about contingent competitive behavior. The game-theoretic literature provides normative guidelines about optimal firm behavior in different competitive situations. Because of the emphasis on strategic foresight, rather than concurrent optimizing, the conclusions are based on post-decision competition to infer the right decision.

3.2. Game theory and competitive responsiveness to innovation

Game-theoretic models that deal with competitive responsiveness to new products deal with issues related to entry timing (Narasimhan and Zhang, 2000), new product introductions (Moorthy and Png, 1992) and incumbents' response to new products and new entrants (Kalra et al., 1998; Shankar, 1997; Thomas, 1999). These game-theoretic models provide valuable insight in the mechanisms that influence competitive behavior. In particular, the systematic modeling enables one to trace back the results to the assumptions and the deduction process that follows from them (Saloner, 1991).
3.3. Realism of basic assumptions

Some observers are troubled by the extent and complexity of the reasoning by market players that is assumed in game-theoretic models. The degree of sophistication and rationality required from decision-makers is often substantial. In game-theoretic models, each firm's optimal action depends on the action of its rival. The decision-maker therefore has to make accurate conjectures about its rival's behavior. In order to make that decision, the decision-maker should use backward reasoning and put itself into the rival's shoes and decide what its move would be in different contingencies. The assessment therefore requires assumptions about the rival's rationality as well as about the rival's belief about its competitor's rationality. These assumptions are intensely stringent in a field like strategic management, which tolerates a wide variety of behavioral influences (Saloner, 1991). In reality, managers may hold widely diverging expectations about key variables because of the uncertainty and ambiguity associated with the situation (Amit and Schoemaker, 1993). Organizations therefore fail to reason strategically, and the resulting uncertainty about their competitor's behavior further reduces the motivation to step into their rival's shoes (Urbany and Montgomery, 1998).

The reasons why decision-makers fail to make accurate conjectures about their competitors' actions are multiple. They are particularly relevant when I talk about the effect of new products on competitive behavior.

(1) Companies lack the motivation to precisely assess their competitors' stance. It has been shown that decision-makers are overly confident in their company's ability to deal with possible competitive challenges and in their resulting performance. This phenomenon (referred to as 'reference group neglect') creates the tendency to underadjust for competitors' actions in strategic planning (Camerer and Lovallo, 1999).

(2) Adding to this lack of motivation is the level of uncertainty associated with competitive analysis. In reality, companies do not operate within a full information environment. This is especially the case when new products are concerned. By definition, innovations create instability and turbulence within an industry. Often, the innovation's effect cannot be framed within the boundaries of an existing market setting or within existing product dimensions. The difficulty associated with assessing an innovation's market impact complicates making accurate competitive conjectures.

(3) This inability is further enhanced by the lack of opportunity for learning. Decisions concerning market entry or reaction to competitive entry possess a number of features that hinder learning. They are important and multi-faceted decisions, of which the outcome is delayed and not easily attributable to a particular action. They are also infrequent, which means that decision-makers rarely have the opportunity to see clear feedback from their actions.
3.4. Focus on organizational processes

The industrial organization and game theory literature share with each other two characteristics that distinguish them from the theoretical perspectives that follow. First, the role of the manager is understood to be minor. Because competitive behavior is assumed to be governed to a large extent by the environment, the number of decision variables is limited. The role of the manager is also limited in terms of the behavioral assumptions that govern managerial behavior. In fact, managers are assumed to be rational and unbiased. Second, the heterogeneity between firms is assumed to be minor. The competitive environment of the company is emphasized as the more significant impact on its competitive behavior. Because of this external perspective, the internal situation of the company receives less attention.

Consequently, different scholars have developed other perspectives on competition that complement these views and place more emphasis on the impact of organizational processes. They draw upon the study of organizational economics and organizational change. More attention goes to (1) the role of the manager and to (2) the heterogeneity between companies induced by their different resource base. The resource-based theory of the firm emphasizes the role of internal company characteristics as represented in its resources and capabilities. The behavioral theory of the firm draws upon decision theory and emphasizes the influence of managerial decision-making processes in determining the company's behavior.

I believe these theories are particularly valuable in the study of competitive response to innovation. As valuable as the game theory approach is in exposing competitive interactions, its applicability is mostly showcased in situations where competitors are closely matched and the identity of their strategic alternatives can be readily ascertained (Tece et al., 1997). The competitive imbalance and uncertainty induced by innovations makes it less useful to formulate the competitive moves and countermoves in game-theoretic terms. Competitive perspectives that recognize the entrepreneurial side of strategy are more valuable in this case. Also, the uncertainty associated with new products increases the relevance of managerial assessment and decision processes. The decision-maker plays a more critical role in interpreting external information that is ambiguous than if the situation is straightforward.

4. RESOURCE-BASED COMPETITION

4.1. Fundamental Principles

The resource-based view of the firm acknowledges that firms are fundamentally heterogeneous in terms of their resources and capabilities (Peteraf, 1993). In fact, these resources and capabilities are believed to be at the core of a company's performance and to be the prime differentiator between companies. This
means that heterogeneous firms can co-exist and obtain rents within the same market environment. At the heart of a company’s strategic decisions is not the search for attractive market environments (as dictated in the industrial organization perspective) but the firm’s ability to exploit its distinctive resources and capabilities (Wernerfelt, 1984). In contrast to the industrial organization school, the resource-based view of competition leaves a lot more to the manager’s discretion. The task of the manager is to envision and implement the development of resource and capabilities that create a superior competitive position. The resource-perspective also claims that competitive analysis should be based on examining the resource positions that create different companies’ competitive advantages. By analyzing his resource position, a manager would have a clearer understanding of the competitive situation.

4.2. Resource-based competition and competitive responsiveness to innovation

Research that takes a resource-based view to innovation has pointed out the enabling as well as limiting role that companies’ resources and capabilities can play.

Tushman and Anderson (1986) differentiate competence-enhancing innovations from competence-destroying innovations. Competence-enhancing innovation builds upon and reinforces existing technological competencies, skills and know-how. Competence-destroying innovation obsolesces and overturns existing competencies, skills and know-how. This distinction in terms of organizational effects is particularly relevant to understand the effect of innovation on incumbents. Because of the disruptive nature, incumbents are expected to perform worse on competence-destroying innovations (Gatignon et al, 2000). Competence-destroying innovations therefore represent an opportunity for new entrants to come in and overthrow the established leadership positions (Tushman and Anderson, 1986; Han et al, 2001). Competence-enhancing innovations on the other hand enable incumbents to enhance their position by building upon their existing capabilities and expertise.

The effect of existing capabilities on innovation within a company transcends pure technological capabilities. Complimentary assets are geared toward the commercialization of innovations. Firms are more likely to develop new products for which they can utilize existing complimentary assets such as distribution networks, customer relationships, manufacturing capabilities, service procedures, etc. For example, a company will allocate more resources to new products that are directed towards existing customers about which the company has knowledge (Christensen and Bower, 1996). If technological evolution obsoletes the importance of existing complimentary assets, existing companies are more likely to fail (Tripsas, 1997). This means that a lack of adaptability to new circumstances is embedded within the history of the company. When radical change is needed, core competences can become core rigidities (Leonard-Barton, 1992).
The resource-based perspective is therefore also useful in understanding the importance of competitive responsiveness towards new product developments. Having the ability to sense the need to transform and adapt to changing circumstances is critical if a company does not want to get trapped in its own path (Teece et al., 1997). This implies that competitive responsiveness in itself is an important capability. Therefore, it is important to have explicit, undistorted and dynamic mental models of the competitive environment (Day, 1994).

5. BEHAVIORAL THEORY OF THE FIRM

5.1. Fundamental Principles

Behavioral theory about the firm's competitive behavior emphasizes organizational decision processes. It is situated at the crossroads between organization theory, strategy and decision-making. It incorporates the perspective of bounded rationality and decision framing. The key argument is that organizational actions can only be understood by understanding managerial cognition. Central to the understanding of competitive behavior is the way the company processes information. Because of the view of the organization as an information-processing mechanism, the manager plays a central role here. Managers are assumed to be information processors (Walsh, 1995). They spend their time absorbing, processing and disseminating information. Because decision-makers play an important role in organizations' strategic decisions, it is necessary to investigate the cognitive factors that influence the choices they make. Of particular relevance to the studies presented in this dissertation are the scanning-interpretation-action paradigm and the knowledge structure literature.

5.1.1. Scanning-interpretation-action paradigm

Increasing emphasis has been placed on understanding the link between how managers make sense of information and how they act to influence organizational outcomes. Because modern organizational environments are complex and dynamic, a key role of management has become to provide meaningful interpretations of patterns of ambiguous information (Thomas et al., 1993). The scanning-interpretation-action paradigm has been used to describe the way organizations deal with changes in their environment (Daft and Weick, 1984; Dutton and Duncan 1987; Kiesler and Sproull, 1982). It claims that organizational adaptation is based on a process that involves information-seeking, assigning meaning to that information and acting upon it. Interpretation entails the fitting of information into some cognitive structure for understanding and action. Researchers have often viewed interpretation as a process wherein people assign labels to incoming information. Two of the most frequently used labels are 'opportunity' and 'threat' (Jackson and Dutton, 1988; Schneider and De Meyer, 1991). The interpretation of information then provides the basis for action. This implies that organizational action in response to
external events can be understood by investigating the content of the interpretation attached to these events.

The existing research within the scanning-interpretation-action paradigm is mainly situated within the field of organization theory. Consequently, a lot of this research looks at the influence of the organizational context on interpretation (Denison et al., 1996; Lant et al., 1992; Thomas et al., 1994). Other work within decision theory concentrates on heuristics and biases that constitute the simplification processes that influence the interpretation of issues (Barnes, 1984; Schwenk, 1986; Zajac and Bazerman, 1991). More recently, the strategy field has taken up interest in investigating the link between managerial sense-making and organizational change by recognizing that the process of strategic change is causally linked to the cognitive processes of decision-makers (Dutton and Duncan, 1987; Schwenk, 1995; Barr, 1998).

5.1.2. Knowledge Structure

Several terms have been used to label the fact that managers use cognitive representations of the environment as a basis for their decisions: mental models, knowledge structures, schemata, cognitive maps and cognitive taxonomies. Each of these terms can be defined as a mental structure consisting of organized knowledge about an information environment that enables interpretation and action in that environment (Walsh, 1995). This knowledge structure is built up over time, based on past events, actions and results. It helps managers cope with an overabundance of information. A knowledge structure acts as a mental template that individuals impose on information to give it meaning (Walsh, 1995). Because it is a simplified representation of reality, it facilitates the encoding of new information (Day and Nedungadi, 1994).

The effect of the mental model on the scanning-interpretation-action process is threefold (Barr et al., 1992). First, it determines what information is collected and receives attention. It thus operates as an information filter. Second, it influences the interpretation of information because information is assessed in reference to the existing mental model. The mental model is therefore described as a lens through which decision-makers view their world (Dutton and Duncan, 1987). Third, it directs action by limiting and guiding the options that are considered. More importantly, it can limit organizations' ability to cope with major change because this does not fit the existing logic (Bettis and Prahalad, 1995). A well-defined cognitive taxonomy can be a source of inertia because it is deeply rooted within the organization and is not easily changed (Porac and Thomas, 1990).

The concept of knowledge structures lies at the roots of the competitive cognition literature. This research deals with the intersection between strategic decision making and competitive decision making. It
examines the existence of mental models in competitor identification. Decision-makers do not hold a perception of their competition as a homogeneous field. Instead, they operate on a mental model of their competitors that classifies them into different categories according to a limited number of salient perceptual dimensions (Clark and Montgomery, 1999). This means that the competitive space is simplified and segmented to help make sense of it (Porac et al., 1989). The different categories of competitors constitute cognitive strategic groups (Reger and Huff, 1993). Because of the above-discussed effects of mental models on the scanning-interpretation-action process, this competitive view significantly affects competitive behavior. It confines attention to a limited number of competitors that are believed to be similar. The constriction of competitive scanning to a small number of competitors makes it tractable and feasible. The mental model of competitors also directs the interpretation of competitive actions to fit with this existing framework. As a result, the existing mental model is reinforced by enactment processes towards a mutually defined set of competitors (Porac et al., 1989; Osborne et al., 2001).

5.2. Behavioral theory and competitive responsiveness to innovation

The amount of existing literature that explicitly incorporates cognitive elements in studying competitive responsiveness to innovation is still limited. Chandrashekarani et al. (1999) incorporate assumptions based on the bounded rationality of decision-makers. They demonstrate that inertia characterizes successful firms and decreases their innovativeness. Initial evidence also shows the impact of cognitive representations on how firms respond to technological discontinuities. Because these knowledge structures are based on prior experience and deeply rooted within the organization, they constrain the ability of a firm to deal with radical change. Existing beliefs about the industry direct learning efforts and influence the development of new capabilities (Tripsas and Gavetti, 2000). They therefore determine to which new technologies the company is willing to allocate resources.

Although the competitive cognition literature has received increasing attention, the level of empirical work has not matched this interest. In particular, there is need for research that establishes the link between thought and action (Walsh, 1995). This would enhance the legitimacy of the study of managerial cognition and its role in competitive behavior (Meindl, 1994).

6. POPULATION ECOLOGY THEORY

Population ecology theory originated in biology to study the evolution of populations of organisms. It is based on the principle that species within the same environment compete for limited resources. As applied to the study of organizations, population ecology theory provides a supply-side theory of market evolution that takes into account the evolution in competitive intensity (Lambkin and Day, 1989).
Population ecology models specify the process at which the population of suppliers grows. A central understanding is that the population of suppliers grows proportionally to the difference between the present population size and the equilibrium level population size (Hannan and Freeman, 1977). This equilibrium level can be interpreted as the ‘carrying capacity’ of the market. The most popular form of this model uses a logistic growth curve. According to this model, the rate of entry of new competitors is also related to the current number of entrants. This implies that increased entry of suppliers attracts new entrants in turn.

Organizational and institutional theory provides theoretical and empirical evidence that companies engage in practices that are adopted by a large number of other organizations, even without the manifestation of positive experiences. Two forces can provide the foundation for this process (DiMaggio and Powell, 1983). First, coercive isomorphism results from formal or informal pressures from outside agents that influence an organization’s behavior. In the case of a new market created by an innovation, the pressure from outside stakeholders on incumbents not to forego the opportunity can be considerable. Second, mimetic isomorphism results from the ambiguity that is present in a high-uncertainty situation (Haveman, 1993). To deal with this, organizations follow the footsteps of others and model themselves likewise. Especially in contexts of high uncertainty, as is the case at the initial stages of an innovation’s market development, this frequency-based imitation prevails (Haunschild and Miner, 1997). Because of the uncertainty associated with potential outcomes, imitation of other organizations happens even without evidence of success. The mere fact that several other firms took the same action induces its legitimacy. This legitimation effect is prevalent in density-dependence models for organizational entry (Hannan et al., 1995; Hannan, 1997; Ranger-Moore et al., 1991). The basis of these models is the idea that increased population density initially increases a population’s legitimation and therefore has a positive effect on the entry rate. Increased density however also generates intensified competition, which has a negative effect on founding rates. This competition effect corresponds to the ecological hypothesis of saturation of the existing resource base. The resulting entry rate is assumed to be proportional to the legitimation effect and inversely proportional to the competition effect.

Population ecology models are aggregate models of entry timing of individual organizations. They describe the number of competitors that enter over a period of time, and can thus also be described as portraying a process of diffusion. An analogy can be drawn between these models and customer diffusion models. Customer diffusion models depict the number of consumers that adopt an innovation over time. These models are well-documented in the marketing literature (Mahajan et al., 1995; Bass, 1969; Bass et al., 1994). In contrast to the attention that customer diffusion received, competitive diffusion is a largely ignored issue in marketing research. The two perspectives however represent two sides of the same coin. An integration of these supply- and demand side evolutionary models is missing in the current literature. Demand-side evolutionary models as represented in customer diffusion models neglect
to incorporate the impact of supply-side dynamics. Alternatively, population ecology models mostly treat
supply side evolution as a self-contained process, and do not incorporate environmental evolution.
Within the theoretical perspective of population ecology as a reflection of competition for finite resources,
this constitutes a major deficiency because the demand-side population is an important resource for
which organizations compete.

Also, it has been argued that population ecology does not recognize the impact of managerial decision-
making. The fate of organizations is largely assumed to be environment-driven. This does not reflect the
influence of individual firms' strategic choices nor does it account for firm heterogeneity.

7. INTEGRATION OF DISSERTATION TOPIC WITHIN SCHOOLS OF THOUGHT

7.1. Relevant research themes

The preceding discussion reviewed five different theoretical approaches to competition. They represent
different, but not necessarily conflicting views about the sources of competitive advantage. The different
research streams therefore emphasize distinct determinants of competitive behavior. They are also
different in nature concerning their approach to research. The industrial organization and game theory
literature excel in their systematic approach and quantitative rigor. Both the ecological, behavioral and
resource-based literature excel in theoretical richness but often lack empirical and quantitative
verification.

The purpose of this section is to position the studies presented in this dissertation according to (1) the
different fundamental theoretical perspectives and (2) the major research themes discussed in the
literature that relate to the topic of this dissertation. Table 2 presents four major research themes that are
relevant to the studies presented in this dissertation. The gray areas in Table 2 depict the dominant
theoretical paradigms through which these themes have been investigated.

The four themes represent broad categories of issues that have been studied. Each category contains a
myriad of different research questions that pertain to the general theme. Specific research questions that
fall within each category are mostly inspired by the applied theoretical foundation.

First, studies that investigate the occurrence and nature of competitive reaction to new products are
central to this dissertation. The dominant theoretical paradigm used in empirical studies is the
positioning school. This implies that major emphasis has been placed on the influence of structural
industry characteristics on competitive reactions. Also, competitive reaction is assumed to be caused by
the threat that new products represent for the market position of existing firms (See Appendix 1.1).
Alternatively, game-theoretical models have been concerned with developing normative implications for reaction in different competitive settings (Kalra et al., 1998; Shankar, 1997; Thomas, 1999).

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Table 1: Integration of research themes and theoretical foundations

A second theme pertains to the issue of reaction as the result of a decision process. Recently, empirical research has become more concerned with explicitly incorporating this process. Within the scanning-interpretation-action paradigm, this implies that initiatives have been taken to measure interpretation of new products by competitors (Klemz and Gruca, 2001; Waarts and Wierenga, 2000).

A third theme that is particularly relevant to this dissertation concerns the response of incumbent companies to the emergence of radical innovations that create a new sub-field within their industry. Within an industrial organization and game theory context, studies that investigate incumbents' response to radical innovation focus on the incentives that incumbents possess to stimulate or hold back innovation and the competitive interplay that results from it (Ghemawat, 1991; Narasimhan and Zhang, 2000). From a resource-based perspective, research has been mostly concerned with the 'stickiness' of organizational resources and capabilities and the impact this has on the companies' ability to evolve
(King and Tucci, 2002; Leonard-Barton, 1992; Teece et al., 1997; Tripsas, 1997). Recently, scholars have begun to add a cognitive perspective to investigate the impact of existing mental models on an organization's adaptability to innovations (Tripsas and Gavetti, 2000).

The fourth relevant research theme concerns the evolution of an industry in terms of the number of competitors. Industrial organization models have investigated empirical generalizations in the pattern of entry and exit in an industry (Geroski, 1995; Klepper and Simons, 1993). Fourth, population ecology sheds light on the longitudinal evolution of industries. Whereas the population ecology literature looks at populations of competitors from an aggregate perspective, the fundamental principles outlined in this literature can also be used in individual-level models of competitive behavior. This population ecology perspective is particularly of interest to study the time dynamics that exist in the reaction of different competitors to innovation, an issue that has not been explored until now.

7.2. Outline of dissertation

This dissertation integrates behavioral concepts within quantitative models of firm behavior to investigate competitive reaction to new products in the industry. Chapters 2 to 4 contain three different papers that address different research questions related to this issue. Table 1 contains an overview of the three studies. The hypotheses that are developed in the three essays assume that competition is resource-based as well as position-based. At the same time, behavioral assumptions about the managerial decision process are integrated in the theoretical development. The approach to research applied throughout this dissertation involves empirical modeling of real-life behavior, in order to enhance understanding of the factors that influence company behavior.
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<th>Chapter 2</th>
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<tr>
<td><strong>Key issue</strong></td>
<td>Influence of new product launch characteristics on competitive reaction</td>
<td>New Product Assessment as a mediator between a new product introduction and competitive reaction</td>
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<td><strong>Data Collection method</strong></td>
<td>Survey</td>
<td>Market data and survey data</td>
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<td><strong>Empirical Context</strong></td>
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<td><strong>Type of data</strong></td>
<td>Cross-sectional</td>
<td>Repeated Measures</td>
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<td><strong>Statistical model</strong></td>
<td>Logistic regression</td>
<td>Multi-level structural equation model</td>
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<tr>
<td><strong>Key results</strong></td>
<td>- Two thirds of new products meet reaction - Centrality and scale of attack influence reaction</td>
<td>- New product assessment contains a motivation and capability component - Motivation to respond is the result of counterbalancing forces of competitive stress and organizational inertia - Liability of success: success decreases motivation to respond</td>
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**Table 2: Overview of chapter 2-4**

**7.3. Positioning and contribution of dissertation**

Table 3 positions the three studies presented in this dissertation in the above-developed framework of research themes and theoretical foundations. The main contribution within each area in which a study is positioned is indicated. Secondary contributions of each paper are indicated between brackets. Obviously, Table 3 reflects a coarse and limited image of the research objectives and contributions of each study. The individual chapters 2 to 4 contain more extensive discussions of specific contributions of the findings of each study. Within the context of this first introductory chapter to the dissertation, Table 3 should be seen as a means to get a rapid insight in the major themes.
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<td>Exposing new product reaction as a decision process</td>
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<td>Chapter 3: Addition of capability perspective to threat perspective</td>
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<td>Incumbents' response to radical innovation</td>
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<td>Evolutionary perspectives</td>
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<td>(Chapter 4): Individual-level instead of aggregate-level model allows for firm heterogeneity</td>
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Table 3: Positioning of dissertation

The first paper of this dissertation uses cross-sectional data to investigate the occurrence and nature of competitive reaction. In that sense, it integrates with the existing empirical studies that investigate the competitive reaction from a positioning perspective. To a lesser degree, this study also integrate ideas from the scanning-interpretation-action paradigm. In particular, arguments for hypothesis-building on the impact of new product launch characteristics are based on (1) the visibility of marketing efforts and
(2) the uncertainty of interpretation associated with radical innovation. Empirically, this study contributes to the extant literature by using a cross-national database from industrial markets in the U.S., U.K. and The Netherlands. Content-wise, this chapter concentrates on the impact of the new product launch strategy on competitive reaction. The results conform with industrial organization economics. They show that the structural characteristics of the market (i.e. market growth) and the extent to which competitive positions are affected by the new product influence competitive behavior. Additionally, the results suggest that behavioral aspects also play a role. For example, the non-response to radical innovations indicates that competitors experience greater difficulty in assessing its impact on the market and in mounting an effective response. However, without explicitly incorporating the components of new product assessment, it is hardly possible to make accurate inferences about the interpretation process that lies behind these findings.

Hence, the objective of the second paper is to make the decision process explicit by focusing on competitors' assessment of new product introductions. This study thus aligns with the scanning-interpretation-action paradigm. It demonstrates that new product assessment operates as a mediating step between the competitive new product introduction and competitive reaction. The addition of new product assessment creates new insights in the reaction decision process. The limited number of studies that have explicitly considered new product assessment suffer from two drawbacks: (1) they define new product interpretation strictly as a threat assessment and (2) they do not distinguish between new product launch characteristics and their interpretation. The presented study in chapter 3 remedies these shortcomings. Methodologically, this essay distinguishes itself by applying a multi-level structural equation model. Although discussions of this type of model are present in the recent statistical literature, it has not been generally adopted in the marketing literature. The empirical contribution stems from the combination of multiple-source data within the context of a market simulation.

The third paper sets out to empirically demonstrate the impact of competitive mental models on the response of incumbents to radical innovations in the market. The theoretical contribution of this paper lies in developing the arguments and evidence for the existence of a contagion effect on incumbents' entry in new areas in their industry. This study fits within the behavioral as well as population ecology view. Its major contribution consists of the empirical demonstration of the consequences of knowledge structures on firm behavior. As mentioned before, the competitive cognition literature hitherto lacks empirical work that establishes the relationship between cognition and action; a status that hinders its widespread acceptance as a valid theoretical model (Meindl, 1994; Walsh, 1995). The empirical setting for this study is the U.S. brokerage industry. A unique, longitudinal dataset was developed through the analysis of archival data. The hazard model applied in this paper investigates the timing of incumbent brokers' entry in the online brokerage market. Because of the longitudinal perspective of the behavior of a population of competitors, this study also contributes to the population ecology literature. Because the
applied model is an individual-level instead of aggregate-level model, the results allow to incorporate individual firm differences.

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1. INTRODUCTION

In the contemporary competitive context, new product development takes on a critical role (Tomkovich and Miller, 2000). New products assume a substantial share of a firm’s turnover. Products introduced during the previous five years account, on average, for 30% of a firm’s profit (Griffin, 1997). Within this context, passivity is lethal (D’Aveni, 1999). Companies that fail to react to challengers on the market consistently suffer from market share erosion (Ferrier et al., 1999). Because fierce competition erodes the competitive advantage of firms (Christensen, 1997), they must increasingly complement their traditional competitive analyses and long-term strategic planning with the necessary capabilities to adapt to changing circumstances: "If firms cannot forecast they must have the capability to respond quickly" (Bettis and Hitt, 1995). Being able to react quickly and insightfully to competitive moves becomes increasingly important. This is particularly true when these competitive moves represent the introduction of new products, as these really reshape the market.

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However, while competitive analysis constitutes the starting point of many strategy formulation efforts within the firm (Porter, 1980), a recent meta-analysis of the new product success and failure literature suggests that the extant studies have largely ignored the effect of the external environment on new product performance (Montoya-Weiss and Calantone, 1994). Nevertheless, the success of a newly introduced product cannot be adequately explained without considering the competitive situation. Indeed, the success of a new product is partly determined by the reactions and moves of competitors (Chen, 1996). Although empirical research on the antecedents of competitive reactions is still scarce (Weitz, 1985), it is important to develop a profound understanding of industry dynamics in order to cope successfully with the competitive implications of market actions (Bettis and Hitt, 1995). Previous research has demonstrated that competitive reaction to external events is based on the characteristics of that event (Chen et al., 1992; Dutton and Duncan, 1987; Dutton et al., 1983). Focusing on new product launch, I postulate that the characteristics of the new product launch influence competitive reaction. Thus, the present chapter investigates the influence of the launch strategy of a new product on the likelihood of competitive reaction. The research question of the present chapter can be stated as follows: what are the characteristics associated with the launch of a new industrial product that trigger competitive reaction?

On the basis of a literature review, I develop a propositional model. In order to test the hypotheses, an ex post facto field study was designed, in which I obtained comprehensive information on 509 new industrial products launched by 316 Dutch, English and American companies. The chapter discusses the research method, the empirical findings, and the theoretical and managerial implications.

2. THEORETICAL FRAMEWORK

Previous empirical research suggests that the occurrence of competitive reaction is influenced by the characteristics of (1) the action itself (Chen et al., 1992; Kuester et al., 1999; Waarts and Wierenga, 2000) and also by (2) the market context (Kuester et al., 1999; Ramaswamy et al., 1994; Shankar, 1999), (3) the acting firm (Bowman and Gatignon, 1995; Shankar, 1999; Waarts and Wierenga, 2000) and the reacting firm (Bowman and Gatignon, 1995; Kuester et al., 1999; Robinson, 1988; Shankar, 1999). Appendix 1.1 provides a more detailed discussion of the explanatory studies on competitive reaction to new product introductions. This is followed by an overview of the different studies and of their empirical results (Appendices 1.2 and 1.3).

From the innovator’s perspective, an insight into the contingent reaction behavior of its competitors is important in order to develop an efficient and effective launch strategy. It is particularly relevant for innovators to be able to infer how their own behavior will influence how their competitors react. To date, the literature on competitive reaction still leaves a lot of unanswered questions, particularly about the influence of launch strategies. By addressing this, the main contribution of this chapter lies in the examination of the impact of the characteristics of the new product launch on competitive reaction, a
subject matter that has been largely neglected by previous studies. I am especially interested in identifying general relationships between the new product introduction competitors are confronted with, and their subsequent reaction. Individual competitors' differences, conditioned by their market position and resource base, may influence how they react, but I am specifically interested in the overall effect of launch strategy decisions on the likelihood of competitive reaction.

Figure 1 presents the research framework employed in this study. A wide variety of competitive reactions to new product launches are possible, ranging from internally oriented changes (i.e. actions affecting the firm's internal operations) to externally focused reactions (i.e. actions that have an impact on the market). Adopting a marketing viewpoint, I focus on changes in the competitors' marketing approach. This choice is based on the fact that it through these outbound marketing processes that companies actually affect the marketplace (Day, 1994). The type of reaction I look at in this study thus concerns change(s) in the marketing mix of competitors in response to the introduction of a new product.

Figure 1: Theoretical Framework

2.1 Characteristics of the new product launch

This chapter focuses on the strategic decisions that characterize the market introduction of a new product. A distinction must then be made between strategic and tactical decisions. Strategic decisions differ from tactical decisions in the sense that they are more important, involve a substantive resource commitment and are difficult to alter once a trajectory has been selected (Grant, 1991). The literature suggests the following critical strategic decisions related to new product launches: product newness (Hultink et al.,

2-3
1997; Yoon and Lilien, 1985), marketing efforts (Gatignon et al., 1990; Guiltinan, 1993; Shankar, 1999; Yoon and Lilien, 1985) and targeting strategy (Lambkin, 1988 & 1992).

2.1.1. Product Newness

Empirical research suggests that the innovativeness of a new product triggers retaliatory reaction behavior (Kuester et al., 1999, Robinson, 1988). Especially in markets characterized by a high level of competitive rivalry, innovative products are perceived as possessing a substantive competitive impact (Waarts, 1996). The more innovative a new product, the more it may have significant consequences for the competing firms in an industry. In addition, the introduction of a truly innovative new product also captures more attention than the launch of one more "better mousetrap". From a normative perspective then, competitors must be vigilant in their assessment and determined in their reaction in order to protect their position, and keep up with the pace of industry evolution.

A distinction must be made between radically and incrementally new products. A radical innovation represents a discontinuity within the industry and advances by an order of magnitude the technological state-of-the-art which characterizes an industry (Anderson and Tushman, 1991; Chandy and Tellis, 2000; Gatignon and Xuereb, 1997; Henderson, 1993). Incremental innovations are a logical extension to existing knowledge by introducing refinements or extensions of established designs that result in substantial increased value for customers (Ali, 1994; Banbury and Mitchell, 1995; Dewar and Dutton, 1986; Henderson, 1993). The distinction between radical and incremental innovation thus not implies a judgment of the level of value improvement but rather emphasizes the distinction between products that can be compared to existing products, and evaluated on the same dimensions, and products that break with core concepts of existing offers. Within the category of incremental innovations, a wide range of differences in terms of product newness can still exist among new product launches. To distinguish incremental innovations in terms of product newness I define that an incrementally innovative new product introduces a major functional change (and improvement) to an existing product category but does not represent a real break compared with existing products' functionality and technology (Li and Calantone, 1998).

The competitive effect of radically new products and incrementally new products differs greatly. Compared to incremental innovations, radically new products, i.e. product innovations that are not comparable to the existing spectrum of products create two types of uncertainty: (1) uncertainty concerning the success and consequences of the innovation and (2) uncertainty concerning the target market. The more the actions of the innovating firm depart from the existing business routines in the industry, the harder it is and the more time it takes for the reactor to find an appropriate response (Smith et al., 1989). New products that are similar to existing products may be more easily framed in the existing mental models that managers hold about their markets. New products that do not match the existing
offers in the marketplace, and claim to develop new markets, are much more equivocal in terms of managerial framing. Consequently, it becomes more difficult to assess the information obtained from the new product launch. Since the success of a pioneering product is difficult to predict, competing firms may adopt a “wait and see”-attitude prior to an eventual reaction. They prefer to sustain their existing market strategy, rather than drastically change their course of action (Guiltinan, 1993).

Moreover, the signal that is communicated by means of a radically new product is ambiguous. At first glance, it may seem that this new product does not endanger the existing activities of competitors. Radical innovations may generate the impression not to target the existing market. Christensen (1997) describes in great detail how incumbents failed to respond to new entries in the disk drive industry because (1) they did not recognize them as potential competitors, (2) they were overly engaged in fulfilling their customers’ existing needs, and (3) they were fighting to keep up with their current competitors. While leading firms do not necessarily lack the required technological or innovative capabilities, they often hold a myopic view about the market place (Christensen, 1997; Slater and Narver, 1998). In line with these conclusions, Heil and Robertson (Heil and Robertson, 1991) mention in their discussion of market signaling that new product interpretation is affected by the schemata of the company, which have mainly been developed on the basis of an examination of similar competitors in the same market using a similar strategy.

It then follows that incumbent firms will most likely respond to highly innovative incrementally new product launches because (1) they represent a clear-cut attack on the existing market and (2) they capture the market’s attention. A radically new product, however, contains a more equivocal message and competitors will defect from reaction.

Thus, the following hypothesis is derived:

H1: The likelihood of competitive reaction to the market introduction of an industrial new product is greatest for innovative new products but decreases for radically new products.

2.1.2. Marketing Effort

The greater the amount of marketing resources a firm invests in the development and the launch of a new product, the higher its probability of success (Gatignon et al., 1990; Green and Ryans, 1990; Green et al., 1995; Szymanski et al., 1995). Marketing efforts for the new product accelerate the diffusion process, and speed up the adoption rate of the new product (Frambach et al., 1998; Robertson and Gatignon, 1986). They also stimulate superior long-term market performance (Green and Ryans, 1990; Green et al, 1995). Consequently, the threat of the new product on the position of competitors is expected to increase in magnitude as well as manifest itself rapidly. This perception of threat on behalf of the competitors encourages them to react. Dutton and Duncan (1987) claim that the importance attached to an event
draws from the level of threat arising from that event. New product launches that pose a serious threat endanger a company's existing investments in a specific market. In today's highly competitive and fragmented industrial environment (Cespedes, 1994; D'Aveni, 1994) I expect this consideration to be an important one. Competitors may therefore be expected to feel a strong urge to respond.

Highly sustained new product launches also attract the market's attention. In introducing new products in the market place, innovating firms must allocate substantive resources to the communication of the product innovation (Gatignon et al., 1990), enhancing not only the visibility of the new product towards customers but also towards potential competitors. Action visibility is an important antecedent for competitive reaction. A greater visibility increases the likelihood of reaction (Venkataraman et al., 1997), whereas subtle low-profile actions from innovators run a significantly smaller risk of immediate retaliation (Porter, 1980; Urbany and Montgomery, 1998). Highly visible new product launches will be perceived by competitors as important issues, to which they need to take immediate action (Dutton and Duncan, 1987).

The visibility of distribution and promotion investments differs. Distribution investments for new industrial products very often focus on the development of new channels (Hultink et al., 2000). As such, they do not involve an intrusion on a competitor's traditional playground. Many of these investments also happen outside the eyesight of competitors. Promotion investments on the other hand are targeted at customers, and directly intervene with the competitors' efforts to promote their products. I therefore hypothesize:

H2: The likelihood of competitive reaction to the market introduction of an industrial new product is positively related to the marketing effort the introducing company invests. This effect is bigger for promotion investments than for distribution investments.

2.1.3. Targeting Strategy

The targeting strategy the company employs for a new product determines the number and identity of competitors that are directly affected by the new product launch. As such, it represents the competitive scope of the new product launch (Smith et al., 1992).

If the company employs a selective strategy, it selects multiple market segments. For each market segment selected, the firm customizes its marketing activities and therefore clearly attacks the competitors in that segment. As a consequence, such a strategy directly threatens multiple competitors and thus has a large scope. This increases the likelihood of reaction (Chen et al., 1992).

An undifferentiated strategy targets the whole market with the same product and marketing mix. Consequently, an undifferentiated targeting strategy possesses a wide scope, but none of the competitors is directly affected to a very great extent. The threat that emanates from an undifferentiated launch strategy
is therefore of a limited nature (Smith et al., 1992). It can thus be expected that the likelihood of competitive reaction is smaller than is the case when a selective strategy is employed.

Finally, a *niche* strategy is specifically designed to satisfy a particular customer group whose needs may be insufficiently addressed by other competitors (Porter, 1980). As such, a niche strategy deliberately selects those market segments where rivalry is low, partly because larger competitors are not interested. Therefore, the likelihood of competitive reaction is expected to be small as compared to other targeting strategies.

Thus, the following hypotheses are formulated:

**H3:** Compared to a selective strategy, the likelihood of competitive reaction to the market introduction of an industrial new product using an undifferentiated strategy is lower.

**H4:** Compared to a selective strategy, the likelihood of competitive reaction to the market introduction of an industrial new product using a niche strategy is lower.

### 2.2. Market Characteristics

One might expect that companies operating in swiftly growing markets do not experience a significant impact from the actions by competing firms, since the immediate impact on sales will be modest (Gatignon et al., 1990). However, previous research on industrial innovation suggests that the market growth rate considerably influences the reactive behavior of competing firms. Competing firms are more likely to react faster (Chandy and Tellis, 1998; Kuester et al., 1999) and more aggressively (Kuester et al., 1999; Robinson, 1988; Shankar, 1999) in markets that exhibit high growth rates. Competition may still be fierce and intense, even though the market is growing (D'Aveni, 1994), because a high growth rate triggers great expectations and high levels of vigilance. A growing market is an attractive market, and the expected future profits increase the strategic importance (Bowman and Gatignon, 1995). Companies that have built up a large market share in an emerging market are expected to react vigorously to new competitors that attempt to enter this attractive market (Porter, 1980). If a company has invested considerable resources to develop a strong market position in a growing market, it will retaliate other companies that try to acquire a share of their expected present and future rent (Ramaswamy et al., 1994).

Therefore, I hypothesize:

**H5:** The likelihood of competitive reaction to the market introduction of an industrial new product relates positively to the rate of market growth.

### 2.3. Innovator Characteristics
In developing the theoretical model on competitive reactions to new product launches, I deal with the characteristics of the new product itself and the characteristics of the innovating firm separately. The interpretation of a company’s moves by its competitors depends on its reputation in the market. This reputation is based on the past actions of the company, i.e., its market heritage (Weigel and Camerer, 1988). Therefore, a critical element determining the innovative reputation of competing firms constitutes its prior success in launching new products. An outstanding track record of successful innovations enhances a reputation of success. This influences the way competitors perceive subsequent industrial innovations from this firm, and the likelihood of responding to these new market entries. Introductions from companies that have developed an image of being successful in the development and launch of industrial innovations are watched eagerly by their competitors. Since the competitive impact of their new products is perceived as being higher (Waarts, 1996), new product launches by companies that have an outstanding track record in introducing new products are perceived as more threatening than others. Competitors therefore more likely react.

H6: The likelihood of competitive reaction to the market introduction of an industrial new product relates positively to the previous innovation success the innovating firm has accomplished with its new products.

3. RESEARCH METHODOLOGY

3.1. Research Design

Empirical studies on competitive reactions to new product launches have employed two different research methods: one may either adopt the viewpoint of the reacting company or the viewpoint of the innovating company. The reactor’s perspective (Heil and Walters, 1993; Robertson et al., 1986; Waarts, 1996) is based on the perception and assessment of the new product launch as reported by the reacting firm. Such studies focus on the characteristics of the signal that is transmitted by means of the industrial product launch and its consequent effects on competitive reactions. This approach provides insights into the reaction decisions and reaction processes as reported by the reacting firm. However, it may result in a myopic view. By definition, the data are limited to those new products that competitors were able or thought worthy of noticing and reacting to. This may be questionable for new competitors or for competitors belonging to a different strategic group, whose actions may go unrecognized (Heil and Robertson, 1991). Historical accounts of technological breakthroughs have repeatedly shown that such breakthroughs are often introduced by “industry outsiders” (Christensen and Bower, 1996; Utterback, 1996). Consequently, the collection of data from the reacting companies may cause a serious sampling bias, since such reactions are biased towards major new products launched by key competitors.
In order to overcome the abovementioned methodological problem, I have adopted the innovator's perspective in studying reactive behavior to industrial innovation (Bowman and Gatignon, 1995; MacMillan et al., 1985; Robinson, 1988). This method uses data reported by the innovator. Because it provides accurate information on the product launch strategy, it is particularly suited to study the impact of the action characteristics on competitive reaction.

3.2. Data Collection and Measurement

The data were collected by means of a mail survey in three countries: U.S.A., U.K. and the Netherlands. The sampling frame was limited to industrial companies, within three selected industries: (1) construction and installation, (2) chemicals and (3) transport, storage and communication. Each company was notified in advance by means of telephone. This served two major purposes: to increase the response rates and to check whether the participating firms matched the conditions of the research design. These conditions were: (1) the company had developed and introduced at least one new product during the last five years; (2) the respondent was the key informant because he or she was responsible for the launch strategy of this new product; (3) the company employed more than 25 persons.

Categorical (dichotomous and multichotomous) responses were used in obtaining the descriptions of the launch decisions in order to avoid systematic bias in attributions (Curren et al., 1992). The pretest sequence was iterated three times, involving a total of 20 managers to validate the clarity of the questions. Following each iteration, the questionnaire was adapted. The interviews with the third group of managers indicated that the wording and meanings were clear and no additional improvements were required. Managers also did not experience any difficulty describing their launch decisions by means of these categorical responses. While the questionnaire was originally developed in Dutch, it was subsequently translated and backtranslated by two native speakers for data-collection in the U.K. and the U.S.A.

<table>
<thead>
<tr>
<th></th>
<th>Number of companies</th>
<th></th>
<th>Number of products</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>#</td>
<td>%</td>
<td>#</td>
<td>%</td>
</tr>
<tr>
<td>U.S.A. sample</td>
<td>101</td>
<td>32</td>
<td>165</td>
<td>32</td>
</tr>
<tr>
<td>U.K. sample</td>
<td>138</td>
<td>44</td>
<td>223</td>
<td>44</td>
</tr>
<tr>
<td>Dutch sample</td>
<td>77</td>
<td>24</td>
<td>121</td>
<td>24</td>
</tr>
<tr>
<td>Total sample</td>
<td>316</td>
<td>100</td>
<td>509</td>
<td>100</td>
</tr>
<tr>
<td>Transport/Storage/Communication</td>
<td>107</td>
<td>34</td>
<td>170</td>
<td>33</td>
</tr>
<tr>
<td>Chemicals</td>
<td>72</td>
<td>23</td>
<td>115</td>
<td>23</td>
</tr>
<tr>
<td>Construction/Installation</td>
<td>137</td>
<td>43</td>
<td>224</td>
<td>44</td>
</tr>
<tr>
<td>Total sample</td>
<td>316</td>
<td>100</td>
<td>509</td>
<td>100</td>
</tr>
</tbody>
</table>

Table 1: Sample composition
Respondents provided information on their company (or business unit), the market launch strategy, and the marketing mix changes their competitors made in order to respond to this new product launch. Each company was asked to provide us with information on two new products: one they regarded as being commercially successful and one they regarded as being commercially unsuccessful. This method alleviates the natural bias towards successful products. A balanced sample of a variety of projects was obtained. Data were provided by 316 companies on 509 new products: 59% successful and 41% unsuccessful. Table 1 provides an overview of the sample composition. The response rate on the total sample of contacted companies was 33% in the U.S.A., 30% in the U.K., and 34% in the Netherlands.
## Construct | Variable | Frequencies | Description |
---|---|---|---|
**Categorical variables** |  |  |  |
Product newness | NEW | 12% | Indicates how innovative a new product is in comparison to existing products. NEW=1: the product is more innovative and not comparable to existing competing products (= radical product) |
 |  | 36% | NEW=2: the product is more innovative than competing products in the product category |
 |  | 43% | NEW=3: the product is equally innovative as competing products in the product category |
 |  | 9% | NEW=4: the product is less innovative than competing products in the product category |
Distribution effort | DEXP | 16% | Indicates the resources spent on distribution. DEXP=1: the company spent more on distribution compared to competitors |
 |  | 66% | DEXP=2: the company did not spend more or less on distribution compared to competitors |
 |  | 18% | DEXP=3: the company spent less on distribution compared to competitors |
Targeting strategy | TAR | 24% | Indicates the targeting strategy the company followed. A niche strategy targets one specific customer segment with a product developed just for them. A selective strategy targets several distinct segments with the same product and different marketing mixes. An undifferentiated strategy targets the whole market with the same product and marketing mix. |
 |  | 48% | TAR=1: Undifferentiated strategy |
 |  | 28% | TAR=2: Selective strategy |
Market growth | GRO | 7% | The growth rate of the total market in which the new product was introduced. |
 |  | 43% | GRO=1: Less than 0% |
 |  | 30% | GRO=2: 0-5% |
 |  | 20% | GRO=3: 6-10% |
 |  |  | 20% | GRO=4: More than 10% |
**Continuous variables** |  |  |  |
Promotion effort | PEXP | Min = - 1.52; Max = 2.16; Mean = 0.008575; Standard deviation = 0.765 | Two-item formative measure reflecting the number of different marketing communication instruments that were used in introducing the new product and the amount of resources spent on promotion compared to competitors. |
Previous innovation success | INNSUC | Min = 0; Max = 100; Mean = 47.75; Standard deviation = 25.59 | The percentage of a company’s sales coming from products introduced in the last five years |

Table 2: Measures
Table 2 synthesizes the description and coding of the variables that were used in the empirical part of study. The newness of the product (NEW) was measured by means of a categorical variable, i.e., the relative innovativeness of the new product as compared to competing products, as indicated by the key informant. Promotion effort (PEXP) is measured by a two-item formative variable. The variables used capture both the depth and breadth of the construct. They reflect the number of communication channels employed for the product launch and the amount of promotion expenditures compared to competitors. The distribution expenditures (DEXP) of the new product launch were measured by means of the distribution expenditures in the first year following the introduction, relative to the competitors. The targeting strategy (TAR) of the new product launch was measured by means of a categorical variable for which the key informants made a choice between one of the following three strategies: niche, selective or undifferentiated. The market growth rate (GRO) was expressed by a categorical variable (less than 0%, 0-5%, 6-10%, more than 10%). Finally, the previous innovation success (INNSUC) of the introducing company was operationalized as the percentage of sales coming from products introduced in the last five years.

4. EMPIRICAL RESULTS

4.1. Reaction Strategies

The descriptive statistics in Table 3 show that competitors reacted, according to the data from the innovating firms, to 63.1% of the new product launches. The prevalence of marketing mix instruments used for reaction corresponds to the figures found in previous studies (Robinson, 1988). Price modifications prevailed (43.6%), closely followed by changes in product assortment (35.5%). While changes in marketing communications occurred also rather frequently (23.9%), my data show that changes in distribution in response to a new product launch were rather rare (3.2%). In line with the technological, product-oriented nature of industrial markets (Anderson and Narus, 1999) product adjustments are more frequently employed as a reaction tool, whereas communication tools are less likely used. Changing the distribution policy and operations seems to be the most difficult task to accomplish, or judged to be the least effective, because of the complexity and risk associated with new channel approaches. Changes in distribution strategy are hence unlikely to be used in competitive new product warfare (Anderson et al., 1997). This competitive reaction scenario prevailed across the three industries: the occurrence of competitive marketing mix reactions did not differ significantly among the three industries included in the study.
<table>
<thead>
<tr>
<th>Competition reacted by changing one or more of the marketing mix variables</th>
<th>Percentage of new products to which competitors reacted</th>
</tr>
</thead>
<tbody>
<tr>
<td>Change of price</td>
<td>43.6%</td>
</tr>
<tr>
<td>Change of product assortment</td>
<td>35.5%</td>
</tr>
<tr>
<td>Change of promotion</td>
<td>23.9%</td>
</tr>
<tr>
<td>Change of distribution</td>
<td>3.2%</td>
</tr>
</tbody>
</table>

Table 3: Occurrence of competitive reaction

Table 3 demonstrates that the occurrence of different reaction types adds up to more than 63.1%. In other words, competitors may react with different reaction instruments simultaneously (Table 4). Following Robinson (1988), I form a reaction index to describe the aggressiveness of reaction through the use of multiple marketing instruments. This index, which indicates the number of marketing instruments used in reaction, can range from 0 to 4.

<table>
<thead>
<tr>
<th>Reaction Index</th>
<th>Percentage of total</th>
<th>Percentage of reactions</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 (no reaction)</td>
<td>36.9%</td>
<td>/</td>
</tr>
<tr>
<td>1</td>
<td>30.0%</td>
<td>47.5%</td>
</tr>
<tr>
<td>2</td>
<td>24.9%</td>
<td>39.4%</td>
</tr>
<tr>
<td>3</td>
<td>6.7%</td>
<td>10.6%</td>
</tr>
<tr>
<td>4 (most aggressive reaction)</td>
<td>1.6%</td>
<td>2.5%</td>
</tr>
</tbody>
</table>

Table 4: Reaction index frequency distribution

The results in table 4 demonstrate that single marketing instrument reactions are most prevalent. In almost half of the cases where a reaction occurs, only one marketing instrument is involved. A reaction on two different instruments is also prevalent. One quarter of all new products meets reaction on two different fronts.

4.2. Model estimation

The dependent variable that expresses occurrence of a competitive reaction is of a dichotomous nature, i.e., it expresses whether competing firms have reacted or not reacted to the new product that was introduced in the market by changing one or more of their marketing mix instruments. The respondents subsequently indicated which marketing mix instruments were used.
The explanatory variables are either continuous or categorical. Consequently, I used logistic regression to estimate the model parameters (Pedhazur, 1997). I used the "indicator coding" scheme for all categorical variables, i.e., the coefficients are calculated against a reference category. The parameter estimates thus represent the probability that reaction occurs, in comparison to that reference category. Table 5 exhibits the parameter estimates of the logistic regression analysis on likelihood of competitive reaction. Sixty-one cases were excluded because of missing data, leaving 448 cases to estimate the parameters. The model fit is satisfactory ($\chi^2 = 57.708; df=14; p<0.001$). Model predictions are correct up to 68.1%, predicting 71.3% of the reactions and 61.8% of the non-reactions correctly. The analysis of the logistic regression model encompasses the three country samples. I subsequently tested the model for each country separately, but no significantly different results appeared. Also, adding the country of the new product launch as an explanatory variable for competitive reaction did not significantly improve the model and parameter estimates.

The same model was estimated on price, product and promotion reaction. The model fit the data, predicting respectively 61%, 59% and 59% of the likelihood of each type of reaction. Reactions on the distribution dimensions are not estimated for two reasons, First, the data show that distribution is extremely rarely used to react, and it is always used in conjunction with another marketing instrument. Second, and a possible reason for this finding, is that in the industrial context this study is situated in, distribution changes can be expected to pervade across products, and thus disturb the single product-based competitive reactions I study.

Each marketing mix instrument has a different market impact; I therefore expect a different impact of launch characteristics on the use of different types of reaction. The price level in the industry is a prime indicator of the industry's attractiveness and profitability. Using price to retaliate competitors is therefore a very effective, but also aggressive and possibly detrimental operation (Dolan and Simon, 1996). Marketing expenses in promotion and distribution, on the other hand, are aimed at increasing perceived value and thus can be interpreted as a less aggressive and hostile reaction behavior. It is aimed at restoring the company's competitive position, without creating a profit-destroying competitive battle. Finally, product changes are the most pervasive actions for the company, and directly alter its market offering.

A second type of model is estimated with the reaction index as the dependent variable. Because of the non-normality of the distribution of the dependent variable, applying an ordinary linear regression model would violate the basic assumption of such a model. Table 4 displays the distribution of the reaction index. The characteristics comply with a Poisson distribution: the variable is a count variable, it is distributed with a spike at zero and the mean and variance are similar (Mean = 1.061; Variance = 1.026). Table 6 shows the parameter estimates of the Poisson regression analysis with the reaction index as the dependent variable. This model explains with how many different marketing mix instruments
competitors reacted to the new product introduction. The model fit is satisfactory (Likelihood ratio $\chi^2 = 62.0; \text{df}=12; p<0.0001$).

4.3 Estimation Results

Most importantly, table 5 shows support for the propositional framework. The characteristics of the market introduction strategy of a new product have a significant influence on the likelihood of reactions, confirming earlier findings in the field. This supports the main contribution of this research, which focuses on launch characteristics to investigate competitive reaction. Individual conclusions on the different launch elements are now discussed.
### Table 5: Logistic Regression Results

**Key:** Significance levels are based on one-tail test. •: p < 0.05.

<table>
<thead>
<tr>
<th></th>
<th>- 1.045</th>
<th>- 0.025</th>
<th>0.380</th>
<th>Constant</th>
<th>Product</th>
<th>Promotion</th>
<th>Price</th>
<th>Competitiveness</th>
<th>Hypothesized Sign</th>
<th>Construct Success</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reaction</td>
<td>× 1.0510</td>
<td>× 0.035</td>
<td>× 5.05</td>
<td>+</td>
<td>INNSUC</td>
<td>× Previous Innovation</td>
<td></td>
<td></td>
<td></td>
<td>Market Growth</td>
</tr>
<tr>
<td>CRO=4</td>
<td>× 1.4368</td>
<td>× 0.065</td>
<td>× 1.07</td>
<td>+</td>
<td>CRO=3</td>
<td>× Reference Category</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CRO=2</td>
<td>× 0.881</td>
<td>× 0.020</td>
<td>× 2.05</td>
<td>+</td>
<td>CRO=2</td>
<td>× Reference Category</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CRO=1</td>
<td>× 0.51</td>
<td>× 0.250</td>
<td>× 0.5</td>
<td>× 5.98</td>
<td>CRO=1</td>
<td>× Reference Category</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TAR=3</td>
<td>× 0.217</td>
<td>× 0.376</td>
<td></td>
<td>-</td>
<td>TAR=1</td>
<td>× Reference Category</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TAR=2</td>
<td>× 0.538</td>
<td>× 0.030</td>
<td>× 0.20</td>
<td>× 0.25</td>
<td>DEXP=3</td>
<td>× Reference Category</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PERS=1</td>
<td>× 0.47</td>
<td>× 0.241</td>
<td>× 0.01</td>
<td>× 0.34</td>
<td>DEXP=2</td>
<td>× Reference Category</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Promotion Effort</td>
<td>× 0.002</td>
<td>× 0.001</td>
<td>× 0.03</td>
<td>× 0.45</td>
<td>DEXP=1</td>
<td>× Reference Category</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NEW=4</td>
<td>× 0.002</td>
<td>× 0.001</td>
<td>× 0.04</td>
<td>× 0.38</td>
<td>NEW=3</td>
<td>× Reference Category</td>
<td></td>
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<tr>
<td>NEW=2</td>
<td>× 0.052</td>
<td>× 0.015</td>
<td>× 0.09</td>
<td>× 0.37</td>
<td>NEW=1</td>
<td>× Reference Category</td>
<td></td>
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<tr>
<td>Product News</td>
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<td>× 0.024</td>
<td>× 1.32</td>
<td>× 0.91</td>
<td></td>
<td>× Reference Category</td>
<td></td>
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</tbody>
</table>

**Constructs:**
- **Product:** Product News
- **Promotion:** Promotion Effort
- **Price:** Price
- **Competitiveness:** Competitiveness
- **Hypothesized Sign:** Reaction
- **Construct Success:** Market Growth
<table>
<thead>
<tr>
<th>Construct</th>
<th>Parameter</th>
<th>Hypothesized sign</th>
<th>Reaction Index</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Product newness</td>
<td>NEW=1</td>
<td>-</td>
<td>- 0.492**</td>
</tr>
<tr>
<td></td>
<td>NEW=2</td>
<td>Reference category</td>
<td></td>
</tr>
<tr>
<td></td>
<td>NEW=3</td>
<td>-</td>
<td>- 0.069</td>
</tr>
<tr>
<td></td>
<td>NEW=4</td>
<td>-</td>
<td>- 0.017</td>
</tr>
<tr>
<td>• Promotion effort</td>
<td>PEXP</td>
<td>+</td>
<td>0.276**</td>
</tr>
<tr>
<td>• Distribution effort</td>
<td>DEXP=1</td>
<td>+</td>
<td>0.257</td>
</tr>
<tr>
<td></td>
<td>DEXP=2</td>
<td>+</td>
<td>0.087</td>
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<tr>
<td>• Targeting strategy</td>
<td>TAR=1</td>
<td>-</td>
<td>0.084</td>
</tr>
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<td></td>
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<td>Reference category</td>
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</tr>
<tr>
<td></td>
<td>TAR=3</td>
<td>-</td>
<td>- 0.159</td>
</tr>
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<td>• Market growth</td>
<td>GRO=1</td>
<td>Reference category</td>
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</tr>
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<td></td>
<td>GRO=2</td>
<td>+</td>
<td>0.238</td>
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<tr>
<td></td>
<td>GRO=3</td>
<td>+</td>
<td>0.530</td>
</tr>
<tr>
<td></td>
<td>GRO=4</td>
<td>+</td>
<td>0.469*</td>
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<tr>
<td>• Previous innovation</td>
<td>INNSUC</td>
<td>+</td>
<td>0.005</td>
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<tr>
<td>success</td>
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<tr>
<td>• Constant</td>
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<td>- 0.243</td>
</tr>
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</table>

Key: Significance tests are based on one-tail level: **: p < .01; * : p < .05

Table 6: Poisson regression results

The first hypothesis looks at the impact of the product newness on the occurrence of competitive reaction. Hypothesis 1 is supported by the data. Hypothesis 1 postulates that innovative new products are confronted with the highest likelihood of competitive reaction. Indeed, the likelihood of reaction is lower in every other case, as is demonstrated by the negative parameter estimates. The results thus show a significant relationship between the level of innovation and the occurrence of reaction. However, the difference between more innovative and less innovative products is not statistically significant. Observe, though, that the coefficient is in the expected direction (-0.504; p>0.05). Apparently, competitors tend to react most to new products that (1) either represent a clear non-disruptive innovation for their product market or (2) represent a pure imitation of existing products.

The coefficient for radically new products is negative (-1.370; p<0.01), confirming hypothesis 1. Innovative new products that are launched in an existing product category and market apparently stand the greatest chance of being reacted against, whereas radically new products create a new market and will be less likely reacted to. The magnitude of the parameter estimates also shows that competitors react least of all to radically new products.
With regard to the marketing instrument used for reaction, the effectiveness of different instruments differs. Price and promotion reactions increase the attractiveness of the reactant’s offer and are effective instruments to utilize in an environment that is not confronted with disruptive change. They do not represent an adequate response to radically new products because their effect is mainly felt in the incumbent market. The new type of value proposition represented by the radical innovation cannot be countered by tactics that work to outplay competitors in a fixed game (D’Aveni, 1999). It has been suggested that incumbents respond to radical innovations primarily by improving their own products (Chandy and Tellis, 1998). This suggests that the lower likelihood of competitive reaction to radically new products is mainly due to the absence of non-product reactions. The poisson regression results confirm this finding. The number of different marketing instruments used for reaction is significantly smaller for a radically new product than for other new products.

Hypothesis 2, positing a positive relationship between the marketing efforts spent on the new product introduction and competitive reaction, is partially supported. It was expected that new products that were supported by bigger marketing budgets than those of competitors would observe a higher likelihood of reaction. I expected that the effect of promotion investments would be larger than that of distribution investments. The positive parameter estimates show that higher promotion resources are indeed associated with a higher likelihood of reaction (0.469; p < 0.01). The resources invested in promotion provide the entrant with the opportunity to build up positional advantages. The enlarged opportunity cost of inaction provides a powerful stimulus for reaction. The threat to the competitive position of the company can be answered by improving the attractiveness of the company’s offer (Guiliani, 1993). This way, the company may restore the value added to customers compared to competitors. Reactions on product, price and promotion all have the objective to restore the company’s competitive position vis-à-vis the new entrant. The effectiveness of each instrument depends on the reacting firm’s capabilities, and is not determined by the entrant’s marketing effort (Gatignon et al., 1989). The influence of marketing effort is thus not specific to any type of reaction but extends over marketing mix instruments. We can see from table 5 that the number of different marketing instruments used for reaction increases with the promotion effort put in the launch (0.2755; p<0.0001)

The effect of distribution effort is not significant except on the likelihood of promotion reaction. This suggests that competitors attempt to establish a pull-effect to counterbalance the push-effect of the new product introduction.

Hypothesis 3 is not supported by the data. An undifferentiated strategy does not differ significantly from a selective strategy when competitive reaction is concerned (-0.376; p>0.05). Promotion reaction is more likely in case of an undifferentiated strategy. This may be explained by the primary effect that companies want to receive from their promotion efforts. The main objective of promotion is to differentiate the company’s products from its counterparts. An undifferentiated strategy does not accomplish that, but
instead launches a product that wants to appeal to the entire market. An effective and efficient response to this is to emphasize the company’s own differentiation.

Hypothesis 4, concerning the relationship between a niche strategy and competitive reaction is supported. The reaction likelihood for a product launched with a niche strategy is lower than for a product launched with a selective strategy (-0.598; p<0.05). Niche strategies target a specific segment in the market, which is often ignored by competitors. As such a niche strategy does not involve a central attack on the market position of the competition, and the likelihood of reaction decreases (Chen and Miller, 1994). Because a niche strategy involves tailored value creation for a particular niche, it cannot be effectively nullified by price reactions. This can be observed in the price-reaction model, which shows a significant negative parameter estimate for a niche strategy.

Hypothesis 5 is supported. In low growth markets, the likelihood of reaction decreases, whereas in fast growing markets the likelihood of reaction increases. This is a very important finding. It contrasts sharply with the often-postulated reasoning that competition in slow growth markets increases because competitors have to hunt for each other's market share in order to increase sales (Porter, 1980). As far as innovation is concerned, the data from the large-scale survey research suggest that, in the context of a maturing or declining industrial market, companies do not go through the trouble of reacting to their competitors' actions by altering their own marketing mix. Looking at the characteristics of emerging and maturing markets provides another explanation for this result. In emerging markets, there is still uncertainty concerning the strategy to follow, the structure of the industry, the evolution of technology and the rules of competitive interaction. As a result, companies are quickly willing to adapt to new situations and change their strategy. This is also reflected in the type of reaction used. Market growth primarily influences product reaction. In mature markets the rules of behavior are settled and companies may be reluctant to induce provocative changes that might destabilize the competitive routines in the industry. High-growth markets are usually associated with the early stages of the life cycle (Lambkin and Day, 1989). These early stages are characterized by the absence of product standardization. Several product designs may co-exist and no consensus has yet emerged on the dominant design (Utterback, 1994). Moreover, at the early market stages, competition is more technologically than marketing oriented (Popper and Buskirk, 1992). Competitors emphasize product over other marketing instruments. Reaction on the product dimension can thus primarily be expected in high growth markets (Kuester et al., 1999).

Hypothesis 6, hypothesizing that the previous innovation success of a company fosters reaction, is not supported (-0.005; p>0.05). There is only a significant effect on promotion reaction. It remains therefore uncertain whether competitors react more frequently towards new products introduced by companies that have proven to be successful innovators. From a methodological perspective, the lack of support for hypothesis 6 may also be the result of a measurement artifact. The measure I use is of an ‘internal’ nature. This may not adequately assess the external perception of success.
5. LIMITATIONS AND DIRECTIONS FOR FUTURE RESEARCH

The present study suggests several valuable opportunities for future research. First, I collected the information from the innovating company. The major advantage of this method is that the innovator himself, who can provide detailed information, reports the launch strategy for the new product. By using a sample of successes and failures, one avoids a sampling bias towards major new products that had a big impact on the market. Instead, one obtains a balanced view on new product launches of various types. The major drawback however, is that reactions are reported by the innovator, who is not omniscient. He may be incapable of detecting or experiencing the full range of reactions by competitors. Consequently, he may provide only fragmented information. Reactions such as an intensive direct communication campaign of the competitor, oriented towards its own customers, or an increased service level may be accomplished without the innovating company even noticing. Thus, the validity of the findings in the present research design depends on the capability of the responding firm to gather, analyze and interpret competitor information. Also, the data only include surviving companies. If companies were driven out of the market, potentially because of strong competitive reaction, this does not show up within the sample. This means that the reaction occurrence I obtained is biased downwards. A dyadic research method, utilizing input from both the innovating company as well as the reacting company could avoid the drawbacks of the two methods mentioned.

In the present study, no distinction was made among the individual competitors and their unique reactions. Future research could explore why different competitors respond in a variety of ways to the same new product. This implies that competitive reactions to new products cannot be fully analyzed at an aggregate level, but need to be looked at from the viewpoint of every competitor individually (Chen, 1996).

Third, future research could also employ a more comprehensive repertoire of new product introduction strategies. The presented study emphasizes variables describing the new product launch characteristics. Other variables may provide additional explanations (e.g., context characteristics). In future research, new product launch frequency (Heil and Walters, 1993), seller concentration (Ramaswamy et al., 1994; Robinson, 1988) and market openness (Waarts, 1996) may be added to the model. These market characteristics may assume an important moderating role, since they act as contingency elements.

Finally, future research could also explore the existence of other types of competitive reactions, as well as the timing of competitive reaction. The data lack specificity about the timing of reaction, and the difference in timing between competitors' reactions. For innovating companies planning to introduce a new product, it is critical to know the time that is available to execute their launch strategy undisturbed by competitive countermoves. Therefore, a more detailed account of reaction time is necessary.

In the present study, I focused on changes of the marketing mix. Especially in the case of a highly innovative new product, an analysis of the marketing mix adaptations may provide too narrow a
perspective to acquire a full understanding of competitive behavior. For instance, a competitor may recognize the impact of a new technology and decide to collaborate in a way that benefits both parties. The innovator and the competitor could subsequently decide to enter a strategic alliance that permits the innovating company to leverage its own position by using the resources and the market position of established companies. The interaction that exists among competitors will also influence the assessment customers will make of the market, which in turn influences their buying decision (Robertson et al., 1995). For instance, the presence of multiple suppliers or technology standardization reduces the perceived risk for organizational buyers in favor of adoption (Rosen, 1994; Rogers, 1995). In view of such externalities, accommodating reactions may be beneficial in the long term for the reacting company.

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CHAPTER 3

Competitive responsiveness versus inertia:
The liability of success

1. INTRODUCTION

Competitive interaction is a fundamental element of strategic marketing. Learning from and responding to information about competitors constitutes an important resource that will result in better performance and more innovation (Hunt and Morgan, 1995; Li and Calantone, 1998). Several recent studies showed that companies should be alert when challenged by competitive actions in order to protect and develop a solid market position (D'Aveni, 1994; Ferrier et al., 1999). Firms that remain competitively aggressive and react to their competitor's actions stand a better chance of surviving the competitive battlefield (Smith et al., 1991; Chen, 1996). Given this significance, a growing body of research explores whether and when companies react to competitive actions (a.o. Kuester et al., 1999; Shankar, 1999).

A competitive action is defined as any newly developed market-based move by a competitor that challenges the status quo of the market process (Chen, 1996; Ferrier et al., 1999). In this study I focus on the introduction of a new product by a competitor. As this truly changes the competitive landscape and challenges the market position of competitors, it represents a potentially threatening competitive action. In addition, the introduction of new products constitutes a critical element to a company's survival.

1 In preparation to be submitted
Successful firms obtain up to 49% of their sales from new products, which demonstrates that innovation is a critical capability to remain competitive (Griffin, 1997). It also demonstrates that it is important for innovators that their moves go unmatched by their rivals, in order to reap the full benefit of their innovation efforts. In light of the high failure rate of new products, a better insight into the antecedents to competitive reaction could enable the innovating firm to develop contingency plans that take into account competitive countermoves.

The approach used in this chapter differs from the existing research on competitive reaction to new product introductions. Previous research has mainly attempted to clarify the nature and occurrence of competitive reaction. This implies that the actual underlying motivation of competitors to respond to competitive actions remains unexplored. I claim that differences in competitive behavior may stem from a different assessment of events (Day and Nedungadi, 1994; Barr, 1998; Martens and Kambil, 1999). Managers respond differently to similar events because of the different way they make sense of their environment (Lant, 1992, Ginsberg and Venkatraman, 1995). Understanding the factors that shape how decision-makers assess their competitor's actions is critically important because these assessments actually determine their reactions (Thomas and McDaniel, 1990; Dutton and Duncan, 1987; Daft and Weick, 1984). Thus, managerial assessment is a key component in a company's strategic response to environmental events and should be included as a mediating factor that provides an important link between external events and organizational response. Therefore, we can only gain additional insight in the competitive pressure provoked by a competitive action by adopting a process approach that incorporates the action, its assessment and the resulting reaction (Klemz and Gruca, 2001).

This chapter intends to contribute to the extant literature theoretically, empirically and methodologically. I develop a conceptual model for new product assessment. I demonstrate that an enhanced understanding of the antecedents to competitive reaction originates from looking at their differential impact on the different dimensions of new product assessment. In particular, I provide empirical evidence for the hypothesis that success breeds competitive inertia. This liability of success hypothesis, which is grounded in the behavioral theory of the firm, states that successful firms underestimate the impact of their competitors' moves and therefore remain complacent. The empirical results stem from multiple-source data within the context of a simulated market environment. Methodologically, I extend current practice by using a multilevel structural equation model.

The balance of the chapter is organized as follows. First, I focus on the construct of new product assessment. Subsequently, I develop hypotheses that link new product assessment with its antecedents and with competitive reaction. The next section discusses the research design developed to collect data. The development of appropriate measures and model estimation receives considerable attention. I explain in depth the application of a multilevel structural equation model to the repeated measures
dataset. The article finishes with discussing the conclusions that can be drawn from the results, the limitations and suggestions for future research.

2. NEW PRODUCT ASSESSMENT

In order to develop the dimensions of new product assessment, I rely on the theory of strategic issue diagnosis (Dutton and Duncan, 1987). A competitive new product introduction epitomizes the definition of a strategic issue i.e. a development that affects an organization’s position and performance (Ansoff, 1965). Strategic issues are developments that have not yet achieved the status of a decision event, but have the potential to influence the company’s current or future strategy (Dutton et al., 1983). Thus, specific decision alternatives have not yet come forward, but the decision-maker forms an assessment of the external event. This assessment determines the momentum for change.

Assessment of events contains two aspects: (1) an assessment of the urgency to act upon an event and (2) an assessment of the feasibility of dealing with an issue (Dutton and Duncan, 1987). These reflect the motivation of the company to react and the capability to respond (Chen et al., 1992, Chen, 1996).

The motivation to react stems from the perceived risk of not taking action with respect to an issue. It thus epitomizes the expected impact of passivity (Dutton and Duncan, 1987). This impact is derived from the expected effect of the competitive action (Ginsberg and Venkatraman, 1995). The higher the market effect of the competing new product, the more it represents a threat to the company and the more the company risks deteriorating its performance by not responding. An assessment of risk associated with an event involves two components: (1) the probability that an event will occur and (2) the expected consequences of an event (Bazerman, 1994). In the context of new product introductions, this involves an assessment of the probability that the new product will have an impact on the market, and of the consequences this may have on the reactant. The probability that the new product has an impact depends on the expected performance of the product. The perceived potential of a competitor’s new product reflects the extent to which the new product is expected to be successful. Successful products have a significant impact on the marketplace, which induces decision-makers to react (Ginsberg and Venkatraman, 1992). The consequences of a successful new product introduction depend also on the centrality of attack (Chen and Miller, 1994). The perceived centrality of attack reflects the extent to which a new product is perceived to be targeted at the company’s market. A new product that is perceived to be aimed at important markets or market segments of the company being attacked is expected to have major consequences if it succeeds in acquiring a substantial share of the market.

The capability dimension of new product assessment consists of the decision-maker’s inference about the feasibility of mounting an effective response. This assessment does not involve a particular course of
reaction. Rather, the perceived feasibility to react constitutes an overall gross judgment on the possibility of the company to respond (Dutton and Duncan, 1987). The expected payoff of a reaction results from the expectancy that an effective response is achievable and thus depends on the question whether a reaction is possible and is likely to be successful (Chen et al., 1992).

Although it has been suggested that the capability of the company to respond has some bearing on its reaction behavior, this has not assumed an important role in the extant empirical research. However, various results implicitly suggest that the competitor's inference about the feasibility to react plays an important role in determining the competitive reaction. For example, Gatignon et al. (1989) demonstrated that incumbents react to new entries by employing their most effective marketing instrument, suggesting that the reaction decision is taken with respect to the capabilities of the company. Reactions that require a large effort to implement are less likely to happen (Chen et al., 1992). Also, new products that are perceived as highly threatening are more likely reacted to because these new products cause a great deal of competitive stress (MacMillan et al., 1985; Kuester et al., 1999; Shankar, 1999; Waarts and Wierenga 2000). However, Robinson (1988) found an inverted U-function between scale of entry and reaction. This suggests that a lack of capability to respond to highly threatening new products deters companies to respond. Empirical results also suggest that firms experience a greater difficulty of responding to highly innovative new products, and thus that this capability to respond should be accounted for in order to predict reaction (MacMillan et al., 1985; Gatignon et al., 1997).

According to Dutton and Duncan (1987), the assessment of external events determines the momentum for change and determines whether decision-makers will favor a strong or modest response. I discussed two components of new product assessment: the motivational dimension and the capability dimension. The first one is concerned with the perceived necessity to act and is reflected in the perceived centrality of attack of the new product and its perceived market potential. The second one is concerned with the perceived viability to act. These new product assessment dimensions affect the impetus for reaction.

This leads to the following hypotheses:

H1: The perceived centrality of attack of the new product introduction positively affects the propensity to react.

H2: The perceived potential of the new product introduction positively affects the propensity to react.

H3: The perceived feasibility to react to the new product introduction positively affects the propensity to react.
3. ANTECEDENTS TO NEW PRODUCT ASSESSMENT

I contended that the assessment of a competitive new product introduction by a competitor is a crucial step in the decision process that determines competitive reaction. This implies that it is important to understand the variables that affect this assessment (Lant, 1992). The assessment of strategic issues is determined by the issue characteristics as such, and by the organizational context of the company considering a response (Dutton et al., 1983; Dutton and Duncan, 1987). Consequently, we should look at the new product introduction, but also at the characteristics of the reacting company to identify antecedents for the new product assessment (Figure 1).

![Conceptual Framework Diagram]

**Figure 1: Conceptual Framework**

*Motivation to react: balance of competitive stress and inertia*

The new product embodies changes in the market environment that create pressure on the company to rethink its course of action. The idea that stressful forces erode the fit between an organization and its environment and induce the company to respond is a cornerstone in the competitive strategy literature (Porter, 1980). In a dynamic environment, organizations are forced to monitor the effectiveness of their current strategy, and adapt their course of action in order to answer to the competitive challenges created by their competitors' actions. New products introduced by competitors thus create competitive stress. The introduction of a new product by a competitor is an external event that changes the competitive landscape and may call for a reaction through a change in the company's competitive conduct. Competitive pressure arises from the mismatch between the demands facing the organization and the capacity of the current strategy to respond to those conditions. The resulting competitive pressure
motivates companies to react and defend their position. Competitive stress thus encompasses the incentives to act in response to a competitive action.

The motivation to react that arises from the competitive pressure effectuated by the innovator is counterbalanced by the retarding force within the organization. While the competitor’s action may create pressure, the company cannot respond to every potential hazard. The preferred state of the organization is to remain inert. Organizational inertia has been defined as the propensity of a firm to sustain the status quo and maintain the current course of action (Chandrashekaran et al., 1999). Along with the increased interest for the sources of organizational dynamics, the notion of inertia has received much attention from organizational theorists in the recent two decades. Scholars adopting an inertial view to organizational and strategic change argue that organizations generally resist change and it is their nature to preserve the status quo (Hannan and Freeman, 1984; Boeker, 1997). The emphasis of organization research on inertia has been primarily devoted to structural, institutional and political barriers to change within the organization, often related to factors such as the organization size and age (Kelly and Amburgey, 1991).

The concept of inertia in competitive strategy has not yet acquired much scientific attention (Miller and Chen, 1994). Miller and Chen (1994) define competitive inertia at an overall organizational level: it refers to the level of activity a firm demonstrates in altering its competitive stand. I define competitive inertia as the tendency of a firm to remain passive vis-à-vis a competitive action because of a lack of motivation to respond. Competitive inertia thus encompasses the incentives of an organization to remain inactive (Chandrashekaran, 1999). The drivers of competitive inertia thus represents internal forces that reduce the motivation to respond to the competitive new product introduction.

Competitive stress and inertia are interdependent and are theoretical complements. The effect of both should be evaluated simultaneously. A new product on the market creates pressure, but inertia counterbalances this. It is the simultaneous effect of both that explains the motivation to react. Previous research (Kuester et al., 1999; Waarts and Wierenga, 2000) has focused on the stress component of event assessment (the perceived level of threat posed by a new product launch) but ignored the inertia-component. Within my conceptual framework I account for the simultaneous effect of external competitive stress and internal inertia.

*Capability to react: balance of launch magnitude and reactant resources*

Likewise, I expect the assessment of feasibility to react to hinge upon the balance between external and internal resources. The amount of resources used to support the new product introduction create a barrier for the competition to mount an effective response. This influences the assessment of whether the company is capable of responding. This effect is balanced by the amount of resources the company has available.
Figure 1 summarizes the expected dynamics that affect the new product assessment. In the following paragraphs, I discuss empirically testable hypotheses for each of these.

3.1. Antecedents to the motivational dimension of new product assessment

3.1.1. Competitive stress

The impact of a new product on existing products is primarily determined by its position relative to others (Hauser and Shugan, 1983). Product positioning is a central element of strategy development that aims to create a differential advantage vis-a-vis the competition (Hooley and Saunders, 1993). The creation of uniqueness is one of the prime goals of positioning (Grant, 1998). This unique position is threatened by any new introduction that delivers the same or a similar positioning. If both the attacker and the competitor focus on the same market, the effect of the competitive move is immediately felt and therefore provokes competitive reaction (Chen et al., 1992; Chen, 1996). Consequently, the positioning of the new product is a major determinant to assess whether it can be regarded as a direct attack. The positioning of the new product is thus a key indication of the level of threat the new product poses (Waarts and Wierenga, 2000). Products adjacent to the new product are more vulnerable than others are. Thus, the closer a new product is positioned to a company’s products, the more it poses a direct attack towards the company. Contrary, products that demonstrate a positioning that departs from competitors’ positioning are not recognized as direct attacks and therefore often escape competitive reaction.

I thus hypothesize that:

H4: The closer the positioning of the new product to an incumbent’s product, the more it will be perceived as a central attack.

Subtle, low-profile actions will not be perceived as focused, deliberate attacks that threaten the existence of the company (Porter, 1980; Urbany and Montgomery, 1998). The impact of a highly supported action is greater. Aggressive actions are regarded as direct attacks on the company’s livelihood (Heil and Robertson, 1991). The aggressiveness of a new product introduction can be derived from the fact that the action is not in line with industry customs, such as when a new product is launched with extraordinary effort (Heil and Walters, 1993). The inference of aggressiveness may even play a more important role than the actual consequences that can be expected of the attacker’s action (Heil and Robertson, 1991). Thus a new product introduction that is aggressively sustained by significant marketing investments will be perceived as an intentional and direct attack towards the firm’s market.
H5: The resource magnitude of the new product introduction positively affects the perception of centrality of attack of the new product introduction.

Numerous studies have shown that the higher the amount of marketing resources invested in the new product, the higher the probability of success (Gatignon et al., 1990; Green and Ryans, 1990; Green et al., 1995; Szymanski et al., 1995). Thus, marketing effort invested in the new product will be an important signal to infer the expected success the product will experience.

H6: The resource magnitude of the new product introduction positively affects the perceived potential of the new product introduction.

3.1.2. Competitive Inertia

The behavioral theory of the firm claims that poorly performing organizations are more inclined to change their conduct in response to a changing environment (Cyert and March, 1963; Ketchen and Palmer, 1999). Good performance on the other hand leads to competitive inertia (Miller and Chen, 1994; Boeker, 1997). Success may make managers complacent. Dutton and Duncan (1987) mention that bountiful resources may create a 'fat cat' syndrome, such that organizations become unaware of important changes in the environment and feel invulnerable to them. They feel little pressure to respond to environmental changes (Smith et al., 1991; Hambrick et al., 1993). In other words: in well-performing firms, executives believe that no change of strategy is needed and they feel they can ignore changes in their environment (Boeker, 1997). The supply of resources built by continued organizational success may promote an illusion of invulnerability in the minds of decision-makers. This, in turn, may encourage decision-makers to underestimate the magnitude of a strategic issue (Dutton & Duncan, 1987). As Chandrashekaran et al. (1999) note: "high diffusion rates in competitive markets may result in complacency on the part of the innovator by producing an illusion of security that 'all is well'." Bad performers, on the other hand, perceive innovations as more threatening (Singh, 1986; Lant et al., 1992; Ketchen and Palmer, 1999). This suggests that successful firms undervalue the impact of a competitive new product introduction.

H7: The reactant's success negatively affects the perceived potential of the new product introduction.
3.2. Antecedents to the capability dimension of new product assessment

3.2.1. Launch Magnitude

Highly supported actions mount a significant challenge to tackle. High spending on the new product introduction creates the opportunity to establish customer awareness and solid customer relationships (Gruca and Sudharshan, 1995). The enduring investment of a lot of resources in a market segment may create a competitive barrier (D'Aveni, 1994). In the absence of the necessary resources to counter-attack, a company may withdraw from the fight. Additionally, the commitment signaled by the company introducing the new product enhances the perception the company does not possess the necessary resources to react (Porter, 1980).

H8: The resource magnitude of the new product introduction negatively affects the perceived feasibility of reaction to the new product introduction.

3.2.2. Reactant Resources

The emergence of slack resources that arise from good performance creates leeway to react to competitive actions (Cyert and March, 1963; Singh, 1986). The company gains access to additional resources, which enhances the ability to deal with competitive challenges. The emergence of excess resources enables the company to adapt its resource allocation to incidental evolutions in the environment (Nohria and Gulati, 1996). It creates the flexibility to deal with competitive events. Within this context, decision-makers feel more capable of dealing with external issues (Denison et al., 1996).

Successful companies not only have more financial resources. A company with a strong established market position has added advantages in fighting back to new introductions. Their built-up customer relationships, access to distribution and brand awareness makes them more resilient. Their existing market access also facilitates an effective response.

H9: The reactant's success positively affects the perceived feasibility to react to the new product introduction

Competitors tend to react in a symmetrical way: this means that they employ the same marketing instrument as the original competitive action (Kuester et al., 1999). The evident reaction towards a new product thus is another product introduction or a product change. Therefore, in the case of a competitive new product introduction, it is important to look at the resources the company possesses concerning product development. The technological capabilities of the company determine the range of possibilities for reaction. Competitors will be slow at imitating new products that require substantial effort to
conceive (MacMillan et al., 1985). Thus, limited technological capabilities by the company pose considerable problems concerning the opportunity to react.

Also, if a company has invested substantial resources to develop certain products, priority will be given to actions that build upon these investments in order to extract rent from these invested resources (Chandy and Tellis, 1998; Chandrachekaran et al., 1999). When it comes to appropriating resources, attention is primarily focused on further investing in the products the company has already invested in. Furthermore, non-recoverable costs invested to build the firm’s current products create a tendency of commitment and restrict the company’s ability to change the way it competes (Ghemawat and del Sol, 1998). Thus, no extra resources are available to react to new product developments by competitors that not directly correspond to the own product portfolio.

H10: The more limited the technological capabilities of the company, the lower the perceived feasibility of reaction.

Figure 2 summarizes the postulated hypotheses and presents the empirical model to be tested.

Figure 2: Empirical model
4. RESEARCH METHOD

4.1. Research Design

Previous empirical research on the reaction of competitors to new product introductions relied heavily on survey research (Bowman and Gatignon, 1995; Heil and Walters, 1993; MacMillan et al., 1985; Robertson et al., 1995; Robinson, 1988; Waarts and Wierenga, 2000). Respondents typically are asked to recall a recent new product introduction. For this study, this would imply that reacting companies are surveyed to report on a competitor's new product introduction and their assessment of that introduction at that time. As already mentioned in Chapter 2, the collection of data from the reacting companies may cause a serious sampling bias, since such reactions are biased towards major new products launched by key competitors. Another potential issue with this approach is that respondents report their assessment of a new product introduction at a time when they possess more information about their company response and the product's longer-term performance. This creates the potential for hindsight biases. The survey approach also obscures the discrimination between the actual event and the respondent's assessment of that event. Because of that, there has been a tendency to confound the attributes of a new product introduction with the process of interpretation. However, interpretation involves giving meaning to an observed, objective event, and is colored by the organizational context. Thus, it is important to differentiate the objective characteristics of a new product introduction from its interpretation.

To prevent these problems, this study uses the Markstrat business game as an empirical setting. The Markstrat simulation is a computer-generated model built on a set of relationships that closely simulate real market phenomena. Whilst it is based on science-based knowledge about actual market dynamics, and thus simulates realistically a competitive industry, it offers the advantage of condensing the market evolution in time by simulating the market mechanisms. The Markstrat setting consists of an environment in which 4 to 6 companies compete head-to-head in two different high-tech consumer durable markets. The business environment created in the game is a highly realistic simulation of actual market conditions and contains both autonomous and induced market developments. The participating teams, each representing one of the companies, must make decisions on strategic marketing issues that cover product development, positioning and brand management. Accurate, computer-generated information about the market is available and includes industry data, company performance data and market research data.

Markstrat has been suggested as an excellent environment to study marketing decisions (Gatignon, 1987). It has been extensively used in the last decade in a wide range of studies (Clark and Montgomery, 1998, 1999; Glazer et al., 1989, 1990, 1992; Green and Ryans, 1990; Malter and Dickson, 2001). The relatively "simplified" setting of a simulation allows for the elimination of noise and extraneous influences to the
maximum extent, hence minimizing systematic error variance. As mentioned before, the Markstrat game offers a business context that matches the dynamics and mechanisms of real consumer durable markets.

To clarify the research design, Figure 3 shows the different steps followed for data collection in a flowchart. The participants in the business simulation are divided into teams, each representing a company competing in the Markstrat environment. The extensive market information provided by Markstat is handed over to the participants. They are then allowed for enough time to conduct an individual analysis of the market environment, the performance of their company and of the new products that have been introduced during the previous period. Before returning to their teams, participants are asked for their assessment of the market environment and one selected competitive new product introduction. This timing has been chosen to conform with the definition of issue diagnosis as an essentially individual process that occurs at the time when no particular decision alternatives are developed yet (Dutton and Duncan, 1987; Thomas et al., 1993; Walsh, 1995).

I used a 'New Product Assessment Form' to record individual assessments. To minimize fatigue and boredom, the questionnaire items were integrated into a business analysis exercise that varied at each period. For each time period, the research team selected one of the new products introduced by one of the companies as the critical incident that was subjected to evaluation by respondents. Following the individual analysis of the available information and the response to the questionnaire, participants subsequently joined with their respective team members to take marketing decisions for the next time period.

The design of this study offers many advantages. First, it creates the opportunity to measure assessment of events at the same time they happen, hence eliminating hindsight bias. Respondents individually look into the available data, and immediately communicate their assessment. Second, the research design also enables the researcher to randomly select critical incidents. This way, it can be guaranteed that the critical incidents represent a true random sample of possible incidents. This contrasts with the often-used method of letting respondents answer a survey about the latest competitive new product introduction. This biases incidents towards visible competitive actions that are directly targeted at the company's market.

Finally, by allowing for the combination of different data, common-method variance is avoided. Within this study, three types of measures from Markstrat are combined: (1) measures about firm performance, (2) measures about company strategy and decisions and (3) measures about the individual assessment of the market situation by participants. The latter is not part of the standard Markstrat input or output, and was measured separately.
4.2. Data Collection

The data for this study were collected during an advanced marketing strategy MBA course. The 44 students who registered for this course were divided into two independent industries, with five teams in each industry. Since the Markstrat game covers a hypothetical market, the use of students as subjects is not considered problematic (Glazer et al., 1989). Managers and students only behave differently if the managers possess actual experience in the market under study. Typically, the Markstrat simulation game is played over 10 decision periods. Each team started off with an identical market situation as its competitors. From the first period onward, new products were introduced, so 9 periods could be used for data-collection.

In order to maximize variability of critical incidents across introducing companies, critical incidents were sampled without replacement (Keppel, 1991). This guarantees that the new products under investigation are not biased towards a particular company. In total, 339 usable questionnaires were collected, providing information on a total of 29 different new product introductions. To test the representativeness of the critical incidents selected, the characteristics of these new product introductions were compared to
the characteristics of the other new product introductions. I compared the new products on several aspects e.g. invested resources and market performance. No significant differences were found. I can thus conclude that the sampled new product introductions represent a random selection.

4.3. Development and evaluation of measures

Validated measurement scales were not available for the new product assessment constructs. An extensive literature research was undertaken in the domain of competitive reaction, organizational change and strategic change. In order to develop an initial pool of items, 16 exploratory interviews were organized within 4 firms. The companies varied in terms of the technological intensity and growth of their industry. The respondents were all involved with the business unit’s marketing strategy. A pilot interview enabled us to identify a critical incident (i.e. a new product launched by a competitor) that was used as a platform for the subsequent interviews with the members of the decision team involved in the decision concerning reaction to this new product. Interviews typically lasted 2 hours and covered comprehensively the introduction of the competing new product.

On the basis of the interviews and the literature review, scales were developed that could be used within the context of Markstrat, but are not restricted to this context. The resulting scales were pretested with 16 expert judges who were knowledgeable about the Markstrat business simulation. They were confronted with the same information as in the actual research study and were asked to fill in the New Product Assessment Form. Next, they were questioned about the readability and comprehensibility of the questions, as well as on the wording of the items. The form was subsequently adapted to accommodate further comments.

Table 1 contains an overview of the measures that were used to estimate the hypothesized model. The self-reported items were used to develop multiple-indicator measures. The company’s success was also treated as a multiple-item measure that contains several possible indicators. All other constructs were measured using single indicator observable measures that are part of the results of the Markstrat simulation.

Product positioning describes the positioning of the new product and is operationalized as follows: it represents the smallest distance within the consumer perceptual mapping between the new product and one of the company’s products. This number is reversed so that the product positioning represents the proximity of the new product to one of the company’s products.

The level of advertising and sales resources invested in the new product introduction represent the magnitude of resources invested in the new product. To avoid time and context effects, marketing effort was operationalized as an index, representing the advertising or sales expenditures for the new product compared to the market average in that period. The technological capabilities of the company were
measured by a variable representing the smallest difference in product characteristics that exist between the new competitive product and a product the reacting company is currently technically capable of producing. This distance was defined as the Euclidean distance between products on the five prescribed product characteristics, taking into account the range of each characteristic. This figure is reversed to represent a proximity. The measure for technological capabilities of the reacting company thus indicates if the company is capable of producing a product that shows a high resemblance to the newly introduced product.

<table>
<thead>
<tr>
<th>Construct</th>
<th>Measure</th>
<th>Items</th>
<th>Sample Item</th>
</tr>
</thead>
<tbody>
<tr>
<td>Propensity to React</td>
<td>Self-reported</td>
<td>Multiple-item</td>
<td>&quot;Our company should act in response of the introduction of X&quot;</td>
</tr>
<tr>
<td>Perceived Centrality of Attack</td>
<td>Self-reported</td>
<td>Multiple-item</td>
<td>&quot;X is a direct attack to our market&quot;</td>
</tr>
<tr>
<td>Perceived Potential</td>
<td>Self-reported</td>
<td>Multiple-item</td>
<td>&quot;X will be a success&quot;</td>
</tr>
<tr>
<td>Perceived Feasibility</td>
<td>Self-reported</td>
<td>Multiple-item</td>
<td>&quot;We are strong enough to cope with X&quot;</td>
</tr>
<tr>
<td>Advertising investment</td>
<td>Market Data</td>
<td>Single-item</td>
<td>Indexed advertising expenses</td>
</tr>
<tr>
<td>Sales Investment</td>
<td>Market Data</td>
<td>Single-item</td>
<td>Indexed sales expenses</td>
</tr>
<tr>
<td>Product Positioning</td>
<td>Market Data</td>
<td>Single-item</td>
<td>Proximity within the consumer perceptual mapping</td>
</tr>
<tr>
<td>Success</td>
<td>Market Data</td>
<td>Multiple-item</td>
<td>Net contribution compared to the industry average</td>
</tr>
<tr>
<td>Technological Capabilities</td>
<td>Market Data</td>
<td>Single-item</td>
<td>Proximity in product characteristics</td>
</tr>
</tbody>
</table>

Table 1: Overview of measures

Product positioning describes the positioning of the new product and is operationalized as follows: it represents the smallest distance within the consumer perceptual mapping between the new product and one of the company’s products. This number is reversed so that the product positioning represents the proximity of the new product to one of the company’s products.

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product characteristics, taking into account the range of each characteristic. This figure is reversed to represent a proximity. The measure for technological capabilities of the reacting company thus indicates if the company is capable of producing a product that shows a high resemblance to the newly introduced product.

4.4. Multilevel Structural Equation Modeling

The proposed empirical model is estimated as a structural equation model. This means that the proposed hypotheses are tested simultaneously by investigating the covariance structure of the data. Structural equation modeling has experienced increasing popularity, thanks to its flexibility in estimating multiple-equation linear models and its ability to combine measurement and structural models (Baumgartner and Homburg, 1996). Structural equation modeling is widely recognized as a powerful methodology to capture complex models. However, the regular structural equation model assumes that the observations on which the covariance matrix is based are independent. The dataset used in this chapter originates from multiple administrations of the same questionnaire by the same person (each time about a different competitive new product introduction). Consequentially, these repeated measures are not independent and the estimation should take into account the multilevel nature of the dataset. Structural equation models for multilevel data have been explored by Muthen (1994), Hox (1995), Kaplan and Elliott (1997), Heck and Thomas (2000) and Kaplan (2000).

The linear equations that constitute the multilevel structural equation model are comparable to random intercept linear regression models. The estimation procedure is based on a decomposition of the data into within- and between-level data.

Suppose we have data from \( N \) individuals measured at \( T_i \) times with \( M \) the total number if observations (\( M = \sum T_i \)). The individual data are collected in an \( r \)-dimensional vector \( Y_{it} \). \( Y \) can be decomposed into a within-individual component and a between-individual component. These two components are additive and orthogonal.

\[
Y = Y_W + Y_B
\]

The within component \( Y_W \) represents the deviation from the within-individual mean whereas the between component \( Y_B \) represents the deviation from the between-individual mean. The same decomposition can be used to compute a between-individuals covariance matrix \( S_B \) and a pooled within-individuals covariance matrix \( S_W \). These covariance matrices are also orthogonal and additive.
\[ S_T = S_W + S_B \]

The multilevel covariance structure analysis uses the decomposed covariance matrices \( S_W \) and \( S_B \) instead of the total covariance matrix \( S_T \) which would be used as the input for the single level structural equation model.

Muthen (1994) shows that \( S_W \) is an unbiased estimate of the population within-individual covariance matrix \( \Sigma_W \). \( S_B \) is an unbiased estimate of \( \Sigma_W + c\Sigma_B \).

The scaling factor \( c \) is based on the number of observations per individual.

\[
c = \frac{M^2 - \sum T_i^2}{M(N-1)}
\]

The quasi-likelihood fitting function developed by Muthen (1994) can be written as:

\[
F = N\left\{ \ln|\Sigma_W + c\Sigma_B| + tr((\Sigma_W + c\Sigma_B)^{-1}S_B) - \ln|S_B| - r \right\} + (M-N)\left\{ \ln|\Sigma_W| + tr(\Sigma_W^{-1}S_W) - \ln|S_W| - r \right\}
\]

This expression contains the structural equation modeling maximum likelihood estimator used in standard structural equation modeling software, such as LISREL (Joreskog and Sorbom, 1996). The fitting function for the multilevel structural equation model is similar to the two population covariance structure model where there are \( N \) observations for group 1 and \( M-N \) for group 2. The multiple-group approach should be understood as a method to obtain the estimates of a multilevel structural equation model using the available software. As opposed to the standard multigroup comparison of covariance matrices across a number of populations, the multilevel factor model refers to a total covariance matrix and is therefore a model for one population with observations at two levels of aggregation.

4.5. Estimation Procedure

Because of the multilevel nature of the data, the process deviates from conventional structural equation modeling estimation. The estimation procedure contains multiple steps to assure an optimal specification and estimation convergence. Figure 4 presents a summary of the modus operandi followed in the estimation process. The measurement model is assessed first. Subsequently, structural relations are added (Anderson and Gerbing, 1988). The measurement model estimation specifies the relations between observed measures to their hypothesized underlying constructs, with the constructs allowed to correlate freely. The structural model then specifies causal relations between the constructs.
Estimation Steps:

1. Measurement Model *(details see Appendix 3.1)*
   a. Preliminary Scale Construction
   b. Confirmatory Factor Analysis
      i. Single level
         1. Test of normality assumption
         2. Unidimensionality
         3. Convergent validity
         4. Reliability
         5. Discriminant validity
         6. Stability
      ii. Intra-class correlations
      iii. Multilevel confirmatory factor analysis
         1. Within-model
         2. Within + between model

2. Structural Model
   a. Within model
   b. Within + between model

**Figure 4:** Estimation procedure

A valid measurement model is essential to obtain a well-fitting structural equation model. Therefore, the measurement model for the multiple-item measures is assessed separately first. Appendix 3.1 reviews the details of the construction of the measurement model for these self-report measures. First, an exploratory analysis is carried out to construct preliminary scales. Next, a confirmatory factor analysis was carried out. Muthen (1994) recommends a multi-step approach to estimate a multilevel covariance structure. As the first step, the researcher can test a conventional single-level model. Although the parameter estimates are somewhat biased because the multilevel nature of the data is not taken into account, this model does indicate the appropriate structure of the confirmatory factor analysis. The constructs were tested for unidimensionality, within-method convergent validity, reliability and discriminant validity (Fornell and Larcker, 1981; Steenkamp and Van Trijp, 1991).

Following the estimation of a preliminary single level confirmatory factor analysis model, the multilevel characteristics of the data are investigated. Therefore, the within- and between level variance components of the observed variables are examined. The intra-class correlations range from 0.030 to 0.279, indicating that it is worthwhile to pursue a multilevel model to obtain unbiased parameter estimates (Heck and
Thomas, 2000). The pooled within-individual covariance matrix and the between-individual covariance matrix that provide the input for the multilevel confirmatory factor analysis estimation are calculated with the software program MPLUS (Hox, 1995). The covariance structure model is estimated with LISREL 8.3. One model is formulated for the between-individual variation and another is formulated for the within-individual level. We must use equality constraints between these two models for all of the model’s within-level parameters. Because the goal is to merely control for intra-class correlations and not to explore the optimal between-level model, a maximum covariance structure is specified for the between-level model. This places no restrictions on the between-level model (Hox, 1995). To illustrate the multilevel covariance model, Figure 5 shows the path diagram for the confirmatory factor analysis of the measurement model. The multi-level confirmatory factor analysis has a satisfactory fit ($\chi^2(48) = 90.54; \text{RMSEA} = 0.076; \text{NFI} = 0.95; \text{NNFI} = 0.93; \text{CFI} = 0.97; \text{IFI} = 0.98; \text{RMR} = 0.055; \text{GFI} = 0.95$).

![Path diagram of multi-level confirmatory factor analysis](image)

Figure 5: Path diagram of multi-level confirmatory factor analysis

Because of its importance as the central dependent variable of the path model, the construct validity of the ‘propensity to react’ construct was investigated further. Validating a measure can be done by comparing it to an external criterion that is believed to measure the attribute under study (Kerlinger and Lee, 2000). The reaction measure used in this study is an attitudinal measure that assesses the intention of a decision-maker to react to a competitive new product introduction. Naturally, its relationship to actual reaction behavior is critical in establishing its validity as a measure of competitive reaction. Therefore, a behavioral reaction measure is constructed and correlated to the attitudinal reaction measure. To determine a reaction by a company, I look at its marketing actions for the segment at which the competitive new product is targeted in the period following the new product introduction. The behavioral reaction measure does not discriminate between different types of reaction. It is defined as a dichotomous measure with a value of ‘1’ if (1) the company increases sales-expenditures, or (2) the
company increases its advertising expenditures, (3) the company decreases price by over 10% or (4) the company introduces a new product or changes its current products. The behavioral reaction measure is '0' if none of these happens. Validity is established by a logistic regression of the behavioral reaction measure on the company-averaged attitudinal reaction measure. The logistic regression controls for company-differences with a fixed effect company intercept. The relationship between the attitudinal and behavioral reaction measures is highly significant (parameter estimate = .8656, p=.0008, model likelihood ratio $\chi^2 = 21.875$, df=10, p=.0158). The criterion-related validity of the 'propensity to react' measure is thus convincingly established. I further use the attitudinal 'propensity to react' measure in the covariance structure analysis for the structural model because this individual-level continuous measure fits the structural equation modeling methodology.

The elaborate steps to assess the measurement model assure that the constructs are measured psychometrically adequate and are not at the core of a poor-fitting structural model. The measurement model provides a confirmatory assessment of reliability and validity. The test of the structural model then demonstrates a confirmatory assessment of nomological validity. To account for the repeated measurement nature of the data, the structural model is again defined on the within-individual and between-individual level. All variables, except those that are truly exogenous at the within-individual level are contained in the within-level model as well as in the between-level model (Kaplan and Elliott, 1997). In specifying the model, the different dimensions of new product assessment are not assumed to be orthogonal, but no specific causal relationships are assumed. The structural model was assessed by means of LISREL8.3. The hypothesized model fits the data well, supporting nomological validity of the hypothesized model (Gerbing and Anderson, 1988) ($\chi^2(129)= 200.98$; RMSEA = 0.046; NFI = 0.91, NNFI = 0.95; CFI = 0.96; IFI = 0.96; RMR = 0.049; GFI = 0.93). Only two of the hypothesized structural relationships are not significant. Although the $\chi^2$-statistic is statistically significant, this is not unusual with large samples (Anderson and Gerbing, 1988; Baumgartner and Homburg, 1996). The goodness-of-fit indices testify of a well-fitting model.
5. RESULTS

Figure 6 gives a graphical representation of the estimated structural model.

Figure 6: Structural relations
- : Significant path
- - : Insignificant path

Table 2 and 3 provide the completely standardized solution for the structural paths of the model.

<table>
<thead>
<tr>
<th></th>
<th>Propensity to react</th>
</tr>
</thead>
<tbody>
<tr>
<td>Centrality of attack</td>
<td>0.69**</td>
</tr>
<tr>
<td>Perceived potential</td>
<td>0.35**</td>
</tr>
<tr>
<td>Perceived feasibility</td>
<td>0.17**</td>
</tr>
</tbody>
</table>

Table 2: Structural relations between new product assessment and propensity to react
(*: 2-tailed test, p<0.01)

First, I discuss the structural relationship between new product assessment and competitive reaction. The satisfactory fit of the hypothesized model supports the legitimacy of the conceptual framework that explains competitive reaction. First, the confirmatory factor analysis provides support for the
dimensional structure. Second, the structural relationships provide proof of the positive relationship between perceived centrality of attack, perceived potential, perceived feasibility and propensity to react, confirming hypothesis 1 to 3. Given these results, obtained in a realistic quasi-experimental setting, the motivational and the capability dimensions describing the assessment of competitive actions must be viewed as important antecedents explaining reaction behavior (R²=79.7%).

The argument developed in this chapter states that the assessment of a competitive new product introduction should be considered if one wants to explain competitive reaction. This implies that an individual decision-maker's assessment of the event mediates observable external events towards the propensity to react. To demonstrate that mediation actually happens, I followed a three-step procedure (Baron and Kenny, 1986). Each of these steps tests one of three conditions that need to be satisfied in order to conclude that mediation occurs. The first condition states that the antecedent independent variables should affect the dependent variable. Therefore, I tested a model that omitted the new product assessment elements and only included direct relationships between propensity to react and the five antecedents included in the structural model discussed above. This model shows a significant effect of the antecedents on the dependent variable (3 of 5 estimated relationships are significant) and a good fit (χ²(15)=32.99; GFI=0.98; RMSEA=0.061).

Second, I tested if the antecedents affect the mediators, by omitting the dependent variable from the structural model. I found a model with a good fit (χ²(99)=144.64; GFI=0.94; RMSEA=0.046).

The third condition states that the mediator should have a significant effect on the dependent variable, while the independent-dependent relationships estimated in the same equation should be less strong than found by omitting the mediator. To test this condition I estimated a structural model that included direct relationships from the antecedents to the dependent variable as well as the indirect relationships through the mediating factors. I found that adding direct paths from the antecedents to the dependent variable does not improve model fit. All direct relationships from the independents to the dependent were insignificant in this model.

All three conditions are thus satisfied and I can conclude that new product assessment indeed functions as a mediating effect in explaining competitive reaction from the new product launch.

The perceived centrality of attack is related to the positioning of the new product and the magnitude of the resources invested in the new product. I argued that the positioning of the new product assumes a pivotal role in perceiving it as a direct attack towards one's own market. Hypothesis 4 is supported by the data (coefficient=0.25; p<.01). A new product that is closely positioned to one of the existing products of the company will be perceived as a direct threat to the company's market. But my results also confirm the suggestion that the aggressiveness of the competitive action plays an even more important role in perceiving it as a direct attack (Heil and Robertson, 1991). The estimated path from marketing effort to perceived centrality of attack is significant, supporting hypothesis 5 (sales coefficient=0.17; p<.01 and
advertising coefficient=0.31; p<.01). The effect for advertising investment is even larger than the effect of the product's positioning (p<.01). This suggests that decision-makers will attach more importance to the way the new product is launched than to the actual nature of the new product.

<table>
<thead>
<tr>
<th></th>
<th>Perceived Centrality</th>
<th>Perceived Potential</th>
<th>Perceived Feasibility</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>External drivers</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Product Positioning</td>
<td>0.25**</td>
<td>0.17*</td>
<td>0.03</td>
</tr>
<tr>
<td>Sales investment</td>
<td>0.17**</td>
<td>0.17*</td>
<td>0.03</td>
</tr>
<tr>
<td>Advertising investment</td>
<td>0.31**</td>
<td>0.44**</td>
<td>0.05</td>
</tr>
<tr>
<td><strong>Internal drivers</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Success</td>
<td>-0.17*</td>
<td>0.59**</td>
<td></td>
</tr>
<tr>
<td>Technological Capabilities</td>
<td></td>
<td>0.15*</td>
<td></td>
</tr>
</tbody>
</table>

Table 3: Structural relations between antecedents and new product assessment dimensions
(*: 2-tailed test, p<.05; **: 2-tailed test, p<.01)

The estimated model confirms the competitive stress hypothesis: the perceived potential of the new product is influenced by the magnitude of resources put in the launch. The magnitude of resources invested in the new product has a positive impact on the perceived potential of the new product, supporting hypothesis 6 (sales coefficient=0.17; p<.05 and advertising coefficient=0.44; p<.01). However, the expected impact of the new competitive product is affected by the company's own market position. Successful companies expect that their competitors will be less successful, which again reduces their propensity to respond to the competitive new product. This confirms the inertia hypothesis (coefficient=-0.17; p<.05).

The perceived feasibility of reaction is supposed to be influenced by the resources of the reacting company and by the launch magnitude of the new product. Hypothesis 8, which claims that magnitude of resources has a negative impact on perceived feasibility, is not supported (sales coefficient=0.03; p>.05 and advertising coefficient=.05; p>.05). The influence of the effort invested in the launch on the perceived feasibility of reaction is not significant.

Support was found for the influence of internal drivers of perceived feasibility. The perception of feasibility is enhanced by the market dominance of the company, but the technological capabilities of the company also play a determining role. If the company does not possess an equivalent product to the new product, decision-makers feel less capable of mounting a response. This provides support for hypothesis 10 (coefficient=0.15; p<.05). Market success will play a positive role in the perception of feasibility, as
hypothesis 9 stated (coefficient=0.59; p<.01). Together, these results suggest that the perception of feasibility will be much more driven by a consideration of internal factors than from external factors.

6. DISCUSSION

The premise of the present research is that competitive reaction rests on the assessment decision-makers make of the strategic issues they are confronted with. Understanding this sense-making process thus should lead to a better insight into managerial decision making. Despite the expanding research on issue assessment, little is known about the dimensions of issue assessment in terms of an issue's content and consequences for the firm's strategic position (Thomas et al., 1994). Moreover, there is a lack of research that establishes a link between these sense-making processes and the company's behavior and outcomes (Meindle et al., 1994). This study answers to these shortcomings in the existing literature by investigating new product assessment and by relating it to the company's reaction behavior.

The strategy and innovation literature has been mostly concerned with identifying factors that force decision-makers to act. Similarly, the empirical marketing research on competitive reaction to new products focuses on the forces of threat represented by the new product that evoke competitors to reconsider their competitive stance. The conceptual framework developed in this article complements this perspective by adding the counterbalancing force of inertia. This represents a more complete picture of the dynamics that determine competitive reaction. The tension between competitive stress, induced by a competitive action and competitive inertia drives the competitive behavior of the company.

Contrary to what ordinarily would be expected, the extra resources produced by growth do not make decision makers more active against competitors. In fact, complacency provokes a passive attitude towards competitive events. If I execute the path analysis of the indirect effects of success on the propensity to react through the mediators of perceived potential and perceived feasibility to react, I find that the total standardized effect of success on the propensity to react is not significant. It is only by adding the new product assessment step that we get insight into the processes that lie behind this finding. My results add to the unresolved debate about the influence of the market position of the company on its propensity to react. Bowman and Gatignon (1995) found that more successful companies react faster, whereas Kuester et al. (1999) report the opposite finding. In addition, the market share of the reacting company was found to be negatively related to the strength of reaction (Shankar, 1999; Kuester et al., 1999) but Heil and Walters (1993) do not find a significant relationship. My results suggest that this myriad of results may be caused by the fact that the effect of the company's success on its propensity to react is the result of two opposing forces. On the one hand, successful companies feel more capable to mount a response. On the other hand, they underestimate the potential of the competitive new product,
and are therefore less motivated to react. As shown in previous research, this complacency, which is apparently induced by their very success, can turn lethal on market leaders (Ferrier et al., 1999).

Although it has been acknowledged that products that pose a greater threat are more likely reacted to, little is known about this threat assessment process (Klemz and Gruca, 2001). I add to the extant knowledge by investigating both the content and the influencing factors that constitute the motivation to respond. I also complement the usual focus of the new product reaction research on the threat a new product represents with a perspective on the capability of the company to respond. The fact that this feasibility assessment is mainly determined by the resources of the company, and not by the new product introduction characteristics, confirms the importance of the resource perspective. It also emphasizes the heterogeneity across competitors, which makes them respond differently to their competitors' moves.

The results of this study also show that decisions concerning the response to an external event are driven to a large extent by the internal situation of the company. This conclusion emerges from the effect of the perceived feasibility to react, which is driven by the resources of the reacting company. It is also enhanced by the inertia-effect that diminishes the propensity to react to competitive actions. The significant role played by inertia in determining competitive reaction to new product introductions is especially noteworthy and represents a unique contribution of this research. Given the setting of this study, the significant effect of inertia can only be expected to magnify in a real managerial setting. Indeed, the context of a simulation provides the decision-makers with a comprehensive set of structured market information, which makes it easier to assess external developments. In absence of this, it is much harder to obtain reliable data on the market and on the competitive behavior. Real management decisions often have to be based on unstructured information, subject to varying degrees of uncertainty and reliability. The absence of reliable information about the environment urges decision-makers to turn inwardly even more and rely on the available internal information (Glazer et al., 1992).

The impact of factors specific to the reacting company also demonstrates the path dependency of competitive behavior. If one accepts the premise that reaction to competitive actions is affected by the current resource base if the company, then its future position will be determined by its current state. The importance of factors that are specific to the reacting company, which is demonstrated by this chapter, adds to the extant literature on competitive reaction to external events. This research focuses primarily on the effect of the competitive action and the characteristics of the acting company. The specific situation of the reacting company remains less attended. My results however emphasize that reaction to competitive actions is largely firm specific and should be approached from the perspective of each individual competitor. This conclusion points to the need for more research that takes the perspective of the reacting company in order to enhance our understanding of the drivers for competitive reaction.
7. LIMITATIONS AND SUGGESTIONS FOR FUTURE RESEARCH

The above discussed contributions notwithstanding, my study has certain limitations. This study presents an initial attempt to define and measure the concept of new product assessment, which involved the development of new measurement scales. Although I took great care to extensively test the measures, replication of the findings in other conditions or with new data could help to further validate the measurement scales.

The methodology chosen has many advantages, as outlined above, but also carries certain limitations that should be warranted. First, I used a simulated environment to assess the reaction decision process. Research should determine whether the findings hold equally well in reality. The simulated environment means that participants have to rely more on the formal information provided, and less on their own intuition and experience about the market. However, there exists a long and rich research tradition for using Marksstrat to study managerial decisions. Managers testify the resemblance of the game to their actual business environment and claim that decisions taken do not differ from what would be done in a real-life setting (Kinnear and Klammer, 1987). Second, the use of MBA students as respondents is a limitation of this study. Because of the training they received, they may be more inclined to extensively use and analyze market data. To attenuate this concern, I upheld a fixed time span to investigate the market data, to mimic the time-pressure that managers face in reality.

The experimental conditions offered within Marksstrat also hold certain restrictions. The competitive environment is not subject to abrupt changes. The number of competitors remains stable, without new entering or exiting companies. The new product introductions thus are not launched by new entrants to the market. It would be interesting to explore whether new products coming from new entrants are assessed differently than new products coming from existing competitors. Also, the sample of new product introductions that are investigated do not include radical innovations. Radical innovations are not a clear-cut attack towards the existing market of the competitor, but represent a new, potentially successful track on the borderline of the existing market. The effect of radical innovations on competition cannot be easily addressed in terms of "threat", which is the case for incrementally new products launched into an established market. Therefore, the conclusions that arise from existing research on reaction to new product introductions may not hold for radical innovations.

Another limitation arises from my choice for the individual decision-maker as the unit of analysis. This implicitly assumes that the individual decisions-maker's assessment extend to the behavior of the organization and ignores the collective decision making process within the decision making unit. I hereby disregard the importance of inter-organizational power structures in explaining the behavior of organizations. An interesting research question would be to study whether new product assessment at
the level of the individual decision-maker aggregates to the organizational assessment or whether assessment at the individual level is a reflection of group-level processes.

Within the boundaries of the conceptual framework presented in this study, the empirical model can be extended in multiple ways. The selected drivers for new product reaction cannot predict reactions exhaustively. Additional research should identify other factors involved in determining the assessment of a competitive new product introduction. In particular, researchers could study how the innovator's characteristics affect how its actions are interpreted. These could include, for example, the innovator's size, capabilities, market position and historical aspects such as aggressiveness reputation, success of previous new product introductions or past organizational performance. Second, the antecedents to new product assessment can be extended to include other reactant characteristics. Specifically, it would be interesting to further investigate causes of competitive inertia. Tied-up resources, personal commitments and perceptual biases have been mentioned as potential sources of inertia.

8. CONCLUSION

The findings of this study expand and complement earlier findings about the antecedents of competitive reaction to new product introductions. Specifically, this study differentiates itself by taking a decision-theoretic perspective. I concentrate on the critical issue of how incumbents assess new product introductions by competitors. I provide empirical validation of my conceptual framework by combining market data, company behavior data and self-reported data, gathered within a simulated market environment. The framework that is presented in this study identifies the balancing forces of competitive stress and inertia. My analysis reveals that both forces are present and influence the decision-maker's propensity to react to a competitive event.

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CHAPTER 4

Incumbent entry in new markets: Empirical evidence of contagion

1. INTRODUCTION

Retail brokers confronted with online brokerage. Telecommunication companies confronted with the wireless evolution. Offset printer manufacturers confronted with digital printing. Publishing companies confronted with online news providers... The examples of incumbent companies confronted with new technologies expanding, or at least encroaching into their markets, are bountiful. If the incumbent company is to respond with a like technology is less clear.

Technological change has the ability to transform a market. It often creates great turmoil in an industry and is the basis for successful entry of new firms (Henderson and Clark, 1990; Han et al., 2001). Because of this, it represents a significant challenge for established firms. For example, cellular telephony has transformed the landline communications industry. The question for every telephone company was not only whether to enter into the cellular industry but also how quickly. The ability to produce innovations and keep up with these changing technological developments is critical for a company's long-term survival. When confronted with competitors' new products, companies need to decide how to react, and how soon.

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The decision whether to enter a new area is complex and loaded with uncertainty and risk. Innovations provide opportunities for growth but may also undermine existing competitive advantages and investments. New products carry a great deal of uncertainty, in terms of technology standards, customer expectations and market size.

Moreover, technological discontinuities create a new market niche that is often not a clear-cut attack towards the existing market of the competitor, but perhaps represents a new, potentially successful track on the borderline of the existing market. The effect of this innovation on existing competitors cannot be easily addressed in terms of a "threat", which is the case for incrementally new products launched into an established market, since the degree of encroachment on the existing market is less clear. Again, returning to the cellular example above, did cellular service reduce existing landline calling or merely increase the overall usage. Also, major innovations often come from industry outsiders, which increases the ambiguity in determining the impact (Utterback, 1994).

As an industry evolves, industry incumbents must decide whether to enter new areas early, wait for other firms to take the initiative or never to introduce them at all. Existing research presents anecdotal evidence about the way incumbents deal with new market niches created through technological innovation, but (1) fails to expose the specific mechanisms that determine reaction time, and (2) does not address the competitive conditions that distinguish between incumbents as to how they would react. This chapter presents a conceptual and empirical model to explain the timing of an incumbent's response to a new technology introduced into their market. Specifically, it exposes mechanisms through which the response from an incumbent is influenced by their competitors' response. The empirical context concerns the entry of incumbent brokerage firms in the online brokerage market.

The structure of this chapter is as follows: First, the substantive issue of this study and the research objective are clarified. After that, the conceptual elements of the model are discussed. The third section presents the empirical model and the data collected for the estimation. Fourth, I discuss empirical results that demonstrate the existence of a competitive contagion effect in responding to new markets. I conclude with the implications of this analysis for how a firm might react to a new technological competitive entry.

2. RESEARCH QUESTION

This chapter contributes to the literature on the reaction of incumbent firms to the emergence of niche innovations (King and Tucci, 2002; Mitchell, 1989). Throughout this chapter, when I refer to 'incumbent entry', this refers to the entry of incumbents in a new market that results from niche innovation. I define niche innovations as radical product innovations that create a new market opportunity within an existing industry. Radical product innovations differ from incremental innovations because they employ a substantially different core technology and/or advance the price/performance frontier by much more than the existing rate of progress (Chandy and Tellis, 1998; Dewar and Dutton, 1986; Gatignon et al.,

A critical difference between incumbents and newcomers is that incumbents possess certain assets that are required to successfully produce and sell a product and that are retained from one product generation to the next (Mitchell, 1991). Examples could consist of existing distribution systems, the ability to produce complementary goods or services, efficiency advantages in key components, the possession of human capital, etc. In addition, incumbents possess critical marketing capabilities that advantage them over new entrants to successfully market new products, such as existing customer relations, customer knowledge and market power (Chandy and Tellis, 2000). The difficulty in replicating these assets should advantage incumbents in new industry areas. Incumbents typically are early followers in a new market, a strategy that is motivated from the threat to the company’s core products and from the possession of industry-specific supporting assets (Robinson et al., 1992; Tripsas, 1997). Consequently, new technology pioneers benefit from understanding the process and rationale that determines incumbents’ entry in the new industry subfield created by their product innovation. The objective of this study is to develop an empirical model that incorporates the dynamics of market development and competitive effects to explain incumbent’s reaction to the new technology. Our empirical investigation incorporates cross-sectional as well as longitudinal effects.

The research questions this chapter addresses are: What determines when incumbents enter into a new market niches? How can we explain the heterogeneity in timing of incumbents’ response? Specifically, this study intends to show that the entry time of different incumbents is not independent, but that entry of incumbents is contingent upon other incumbents’ entry.

3. INCUMBENT RESPONSE TO TECHNOLOGICAL CHANGE

Analytical models disagree about the optimal reaction of incumbents to competitive innovation. Depending on the model assumptions, delayed response or pre-emptive response may be in line with profit-maximizing objectives. Nault and Vandenbosch (1996) advocate the eat-your-own lunch strategy. Their model demonstrates that market leaders should be the first to launch next-generation products, regardless of the development cost. The assumption of this model is that there is only room for one player in the new field, and that differentiated competition between the old and new generation is possible. Ghemawat (1991) takes the opposite stand and argues that incumbents have fewer incentives to innovate because of the potential revenue loss due to cannibalization. It is therefore not optimal for incumbents to initiate a major technological innovation. Narasimhan and Zhang (2000) resolve the opposites by developing a contingency model. This model clarifies that the optimal entry time depends on the first-mover advantages and laggard disadvantages that firms possess. The avoidance of laggard
disadvantages can motivate firms to move into a new area. This is because "with competing firms vying for the same market, a firm that chooses not to pioneer a market would confer on its rival the chance to do so and hence would have to deal with any adverse consequence of being a market laggard if the market turns out to be inviting". This means that the entry time that a company chooses depends on the competitive conditions it finds itself in. A company may be reluctant to pioneer a new market for fears of cannibalizing existing sales, but is forced to move anyway if competitors do.

The focus of empirical research that attempts to explain the timing of incumbents' response to innovation has been on internal characteristics of incumbents. Previous research considered the assets of incumbents as a predictor of whether and when they react to an innovation by entering the new area (Mitchell, 1989; King and Tucci, 2002). Other scholars have concentrated on the issue of inertia. It has been observed that incumbents, irrespective of the abovementioned advantages they have, tend to respond tardily to new developments in their industry. Scholars have looked at internal characteristics of incumbents that cause this (usually) slow response to drastic changes in the environment. It has been argued that it is not the result of a lack of technological capabilities (Christensen and Bower, 1996). Several studies have addressed the fact that incumbents fail drastically in the face of major technological change and assign this to the inertia that characterizes large incumbent organizations. This inertia has been attributed to the avoidance of self-cannibalization or to the establishment of organizational routines and decision-making fallacies that contribute to it (Ghemawat, 1991; Chandy and Tellis, 1998; Chandrashekaran et al., 1999).

Incumbents can respond in a variety of ways to new emerging areas in their industry. Typically, the initial reaction is not to retaliate directly towards the area but to improve their current offering by improving the product incrementally (Utterback, 1994). But because technological innovations have the ability to render existing products obsolete, the decision to eventually enter the new market may be critical. Treating entry time as an endogenous issue (Moore et al., 1991), this decision is the focal issue of this study. In contrast to the internal focus of previous studies, I will concentrate on external factors that trigger a response from incumbents. In particular, this study considers the size of the new market and the competitors that are present in it as vital elements to explain incumbent entry timing. The following sections explain the basis for adding these to the model.

4. CONTAGION EFFECTS ON MARKET ENTRY

Research on the effect of competitive conditions on innovation has traditionally focused on the effect of market structure characteristics (Kamien and Schwartz, 1982). Recently, the attention has turned to the influence of actual innovative behavior of competitors (Bowman and Gatignon, 1995; Chandrashekaran et al., 1999). Innovation by competitors is likely to raise the pressure on the organization and increases the
companies' incentives to follow suit. This triggers the assumption that the entry of other organizations in a new market creates the urgency within the company to act accordingly.

A normative perspective on market entry claims that a bigger number of competitors makes a market less attractive and thus reduces the probability that a company enters a new market. However, there is evidence for the exact opposite (King and Tucci, 2002). They population growth models claim that increased entry into a new market attracts new entry in turn (Hannan and Freeman, 1977; Lambkin and Day, 1989). The most popular form of this model uses a logistic growth curve that is similar to the well-known Bass-diffusion model for customer adoption of innovations. According to this model, the rate of entry in a new market is positively related to the cumulative number of previous entrants. This implies that an analogy can be drawn between consumer adoption of innovation and companies' adoption (by entering the new market) in that a contagion effect exists between companies' market entry.

Contagion is defined as a process whereby each adoption of a new practice or product makes the subsequent adoption of a potential adopter more likely (Burt, 1987). It does not presuppose a decision making process that causes the phenomenon (Greve, 1998). The hypothesis of the occurrence of contagion thus does not imply a specific rationale that instigates the notion that the existence of previous adopters increases the attractiveness for subsequent adopters. Contagion can be the result of a mere blind-sighted imitation of others' behavior. The fact that others adopt also carries informational value that may affect potential adopters' decision process. Alternatively, the existence of previous adopters could also actually increase the utility of adoption.

The current literature suggests a number of reasons for the existence of contagion in market entry. It has been shown that the existence of prior entrants increases the market's attractiveness for followers by banking on the 'free-rider' effect (Shankar et al., 1999). Early entrants resolve consumer reservations and establish a market. Followers benefit from this effort. Competitor diffusion thus can be interpreted as a positive feature that encourages following entrants.

The entry of other companies can also reduce uncertainties about the potential of a new market. Expected future profits cannot be derived from past data and demand forecasts can show a great deal of variance. A company considering entry therefore has to rely on premature market signals. The entry from other organizations contains signal value about the benefit of entry because it increases the perception of market attractiveness. This positive effect of preceding entrants has been mentioned in both economics and organizational behavior.

Economists refer to the "demonstration effect" as the positive effect of successful experience of others on the profit perceptions associated with entry. Gort and Konokayama (1982) empirically show that competitor diffusion has a high explanatory power in predicting entry rates.
Organizational theory provides theoretical and empirical evidence that companies engage in practices that are adopted by a large number of other organizations, even without the manifestation of positive experiences. Imitation results from the ambiguity that is present in a high-uncertainty situation (Haveman, 1993). To deal with this, organizations follow the footsteps of others and model themselves likewise. Especially in contexts of high uncertainty, as is the case at the initial stages of an innovation's market development, this imitation prevails (Haunschild and Miner, 1997). Because of the uncertainty associated with potential outcomes, imitation of other organizations happens even without evidence of their success. The mere fact that several other firms took the same action induces its legitimacy. This legitimation effect is prevalent in density-dependence models for organizational entry (Hannan et al., 1995; Hannan, 1997; Ranger-Moore et al., 1991).

5. MODEL DEVELOPMENT

In this chapter, I develop a model for incumbent entry into a new industry area. This model incorporates three forces that influence when companies enter: (1) the contagion effects caused by other companies' entry, (2) the development of the new market, (3) the effect of incumbent characteristics that influence their propensity to enter the new market. The following paragraphs develop theoretical motivations to include each and formulates specific hypotheses about the expected effect.

5.1. Contagion effects of incumbent entry

I adopt an individual firm-level approach to account for competitive asymmetry across firms. Competition manifests itself in dyadic relationships between firms (Baum and Korn, 1996). Therefore, I treat competitive conditions not as a characteristic of market structure because such an aggregate approach fails to recognize the company-specific nature of competition.

The objective of this study is to look at firm-specific competitive conditions that affect the market entry of incumbents. This contrasts with the above-discussed aggregate models of market entry (Hannan and Freeman, 1977; Lambkin and Day, 1989). These support the existence of a contagion effect between competitors. However, they (1) do not consider an individual firm's probability of entry and (2) attach an equal influence of every companies' entry on subsequent entrants.

The micro-level approach to model incumbents' market entry that is used in this chapter allows for a greater level of detail in specifying different mechanisms through which other companies' entry influences the response of a company to the emergence of a new market. First and foremost, I expect the behavior of other incumbent companies to have a primary influence.
The incentive to enter the new market depends on the ability of a company to capitalize on positional advantages, but also to avoid laggard disadvantages (Narasimhan and Zhang, 2000). Although these characteristics are firm specific, incumbents share a similar profile because they are shaped to compete in the same environment. To effectively deal with post-entry competition, incumbents need to be concerned with the expected competition from companies with similar resource profiles. If the complimentary assets that incumbents possess retain their value, an incumbent’s performance will be affected mainly by its order of entry relative to other incumbents, rather than by its overall entry order (Mitchell, 1991; Narasimhan and Zhang, 2000). This means that in order to be successful in the new market, incumbents need to be mainly concerned about the first-mover advantages that other incumbents had the opportunity to build up.

The complimentary assets that originate from the incumbent market encompass customer relations, distribution capabilities, market power, etc. The ability of incumbents to leverage these resources depends on the presence of competitors with those same resources. Incumbents may have little incentive to develop a new area, for fears of cannibalizing their existing market. They may delay acting on the new situation, until other entrants force their hand (King and Tucci, 1999). The entry by other incumbents thus creates incentives for the company to act accordingly.

The rationale for this hypothesis can also be defended from a cognitive perspective. The actions of organizations are directed by the information they are confronted with (Glazer et al., 1992). Through the organizational filters that control incoming information, information about current competitors takes precedence over newcomers. Information with respect to the entry into the new field by incumbent firms thus is expected to have greater access in the organization and draw more attention than the same information about unfamiliar companies.

Different incumbents have a different influence on a company’s behavior. It has been recognized that companies envision a limited set of incumbent competitors when formulating their competitive strategy, and that it is mainly this set of competitors that influences their competitive actions (Clark and Montgomery, 1999; Porac and Thomas, 1990). Competitive cognition theory claims that companies do not regard their competitive landscape as a homogenous group. The classification of firms as focal competitors is based on an underlying continuous process in which firms are rated along a continuum on a number of relevant attributes. These attributes are similarity-based or salience-based. This competitor identification process directs competitive analysis and subsequent behavior. This means that interpretation of competitive events is affected by a firm’s mental model of the competition, which is developed mainly by examining the most salient competitors as well as the most similar competitors (Porac and Thomas, 1990; Heil and Robertson, 1991; Reger and Huff, 1993). This leads to an expected asymmetrical effect of competitive actions on the company’s resulting reactions (Chen 1996). Consequently, I use these salience and similarity dimensions to formulate specific contagion effects that are evoked by the entry of similar and salient incumbents.
5.1.1. Similarity

The entry of a firm in the new market niche changes the competition between this firm and its counterparts. This is an asymmetrical effect that depends on the similarity between the two firms in terms of their market and resource profile. A firm will experience different degrees of competitive tension from each of its competitors because of differences along market and resource dimensions (Chen, 1996). Consistent with the strategic group concept, competitors most closely positioned to the firm are most influential. The behavioral implications of market similarity are that firms are interdependent and feel the effect of each other's moves. The similarity of resource endowments between incumbent firms encourages mutual reaction to each other's moves (Chen, 1996). Resource similarity is important because firms with similar resource bundles are likely to have similar positional advantages (Day and Wensley, 1988). Because of this, the entry of similar competitors creates the impetus to respond likewise (Narasimhan and Zhang, 2000). The probability of entry of a firm in a new field thus is expected to be enhanced by the entry of similar incumbents.

A cognitive perspective confirms this hypothesis and makes the argument in terms of the attention and relevance attached to competitors' moves. Researchers have commented extensively on the tendency of decision-makers to rely on old frameworks to assess new information (Barr and Huff, 1997). This urges established companies to categorize major innovations as irrelevant, because they do not fit within existing frameworks of the market and competitive landscape. Christensen (1997) describes in great detail how incumbents failed to respond to new entries in the disk drive industry. Thus, the resulting failure of leading firms is not due to a lack of technological capabilities, but can be attributed to a myopic view of the competitive landscape (Christensen and Bower, 1996).

Change only happens at the point when new information impels a change in cognitive frameworks (Kiesler and Sproull, 1982). However, cognitive frameworks are built up over time, based on past experiences and established beliefs, and are deeply rooted within the organization. Organizational cognition influences decision-making not only through its effect on the interpretation of new information, but also through its effect as information filter. Because of that it directs the organization's attention and its subsequent behavior (Ocasio, 1997). This means that similar companies receive more attention. Firms perceived to be dissimilar to the company are viewed as weaker competitors, are monitored less closely, and understood less (Porac and Thomas, 1990; Clark and Montgomery, 1999). Heil and Robertson (1991), for example, claim that a high similarity between companies increases the understanding of competitive signals, and thus lends greater credibility to their competitive actions.
The recognition of competitors as similar counterparts not only increases attention to their actions. It also lends greater relevance to them. This judgment of relevance affects contagion (Greve, 1998). To explain this argument, the analogy of market entry with an adoption decision can be made. Adoption theory states that for a previous adopter to influence a potential adopter, the previous adopter and its context must be viewed as similar to the potential adopter, so that the information that it has adopted becomes seen as diagnostic of the value of adopting (Rogers, 1983). Greater similarity between firms indicates that their experiences are more relevant to the firm. Consistent with a social learning view of imitation, network peers who are more similar (and whose experiences are most relevant) are most likely to be imitated. Companies are therefore more likely to imitate the actions from their most similar peers (Haveman, 1993; Kraatz, 1998).

The greater the uncertainty surrounding a decision, the more peer-comparison is used as a guide (Haunschild and Miner, 1997). Entry into a new market carries a great deal of uncertainty. I therefore expect the entry of similar competitors to be particularly significant and influential on the entry decision.

H1: Incumbent entry is positively affected by the entry of similar incumbents

5.1.2. Salience

The above stated argument in terms of the attention and relevance associated with a competitive move extends to the actions of highly salient competitors. Large and prominent firms are more visible. The potential threat these competitors represent and the leading role they play make it likely that they will be observed closely (Clark and Montgomery, 1999). Moreover, their previous success legitimates their current actions (DiMaggio and Powell, 1983; Haveman, 1993). Although the practices that lead to the companies' success in the past may not be applicable in a new environment, the righteousness of their action is inferred from their current status (Haunschild and Miner, 1997; Kraatz, 1998). Imitating large and prestigious peers is therefore a way to cope with environmental uncertainty.

The entry of salient competitors could have a deterring effect on potential followers. I make the argument that the role-model position of market leaders and the threatening effect of their actions prevails above the potentially deterring effect their actions may have. The movement of large incumbents into the new field increases the motivation for other competitors to follow. The risk of cannibalizing current sales holds incumbents back from innovating. However, if a large and successful competitor innovates, the sales erosion is induced externally and is much more prevalent than when it comes from an outsider to the industry. Because the expected cannibalization on sales increases with the entry of a salient incumbent, the incentives to enter the new market increase (Narasimhan and Zhang, 2000).

H2: Incumbent entry is positively affected by the entry of salient competitors

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5.2. Market effects

The market effects in the model provide a baseline for the expected behavior of incumbents over time. The literature on entry timing in a new market claims that the entry timing decision is embedded in the uncertainty that surrounds the market development of an innovation. The entry decision balances the risk of premature entry against the missed opportunity of late entry (Lilien & Young, 1990). The expectation of rewards is a key motivator of innovation (Bayus et al., 1997). The attractiveness of the market is shown by the growth rate of the market. It reflects the long-term potential of the market and the future profits that can be expected from it and therefore is a key indicator of market attractiveness (Gatignon et al., 1990; Bowman and Gatignon, 1995). Given the advantage of entry in a growing market, growing adoption of the innovation should motivate entry into this new market (Shankar et al., 1999). This effect is enhanced if we consider the impact of the new field on the incumbent's market. With high product substitutability, the growth rate of the new market also indicates the rate at which the innovation invades the market. This threat to the incumbent's core products motivates entry into the new field (Mitchell, 1989).

H3: Incumbent entry is positively related to the growth of the new market

6. METHOD

My model explains when incumbents enter a new market, and takes into account the time-dependent dynamics that account for that. The phenomenon of interest is a time-dependent binary event. This can best be modeled by survival analysis or hazard modeling (Cox and Oakes, 1984; Jain and Vilcassim, 1991; Helsen and Schmittlein, 1993; Morita et al., 1993; Allison, 1995). Its supremacy over other possible methods is threefold (Helsen and Schmittlein, 1993; Allison, 1995). First of all, in comparison to logistic regression, which only contains information on the occurrence of an event, survival analysis takes into account the occurrence of an event as well as the timing of the event. Secondly, in comparison to a linear regression with timing of the event as the dependent variable, survival analysis takes into account the cases for which the event has not yet occurred at the final observation time. In other words: survival analysis incorporates right censoring. Finally, the principle of survival analysis is that each observed case at each point in time is prone to a certain risk of experiencing the event. This risk is expressed by the hazard function h(t), which is a function of time and of a set of covariates. The time-dependent nature of the hazard model means that time-dependent covariates can be taken into account, which enables us to estimate dynamic effects.
The general representation of a proportional hazards model with time-dependent covariates is (Cox and Oakes, 1984):

\[ h_a = h(t, X_i(t)) = h_0(t) \exp(\beta X_i(t)) \]

- \( h_i(t) \) is the instantaneous hazard of an observation at time \( t \), which is the probability that the event happens at time \( t \), given that it has not yet happened until time \( t \)
- \( X_i(t) \) is a vector of covariates

A proportional hazards model is used to distinguish between the general market dynamics that influence all incumbents in the same way, and specific dynamics that influence incumbents individually. The baseline hazard function \( h_0(t) \) in the proportional model captures the longitudinal regularities in duration time dynamics. The covariates \( X_i(t) \) shift the baseline hazard up- or downward and capture the variation between observations.

The estimated model considers the effects of the evolution of the market versus the identity of the incumbents that already entered that market on the probability that a company enters the market.

The hazard of entry at time \( t \) for observation \( i \) then can be formulated as:

\[ h_i = \exp(\alpha(t) + \delta \times SAL(t) + \lambda \times MC(t) + \beta \times SIM_i(t) + \gamma \times IC_i) \]

It follows from the discussion of the conceptual model that the model incorporates three types of factors to explain incumbent's entry:

1. market characteristics (\( MC(t) \))
2. contagion effects of other incumbents' entry, which contains specific competitive effects of incumbent similarity \( SIM_i(t) \) (that introduce variation between observations) and general competitive effects of incumbent salience \( SAL(t) \) (that exist across observations)
3. incumbent characteristics (\( IC_i \))

The specific measures in the empirical model are specified in Appendix 4.1.

The market characteristics \( MC(t) \) and incumbent salience \( SAL(t) \) do not vary across incumbents but describe the dynamics over time. They explain the general entry dynamics that can be attributed to the development of the new market, whereas \( \alpha(t) \) captures the time-trend that exists after controlling for this. The individual covariates \( SIM_i(t) \) and \( IC_i \) describe the shift from the baseline hazard that individual observations experience due to individual differences. The characteristics of incumbents influence their timing of responding to new emerging fields in the industry (Mitchell, 1989). To control for these internal
factors that represent the varying resources of incumbents to innovate, covariates\(^2\) for the incumbent characteristics are added to the model (but because of space constraints not discussed in detail in this chapter)\(^3\). The company characteristics that are used to construct the similarity measures are also included as covariates in the model.

7. DATA

7.1. Research Setting\(^4\)

The empirical setting of this study is the retail brokerage industry. In the mid-90's, this industry was confronted with the emergence of online brokerage. Online brokerage can be considered a radical as well as a competence-destroying innovation (Gatignon et al., 2000). It disrupts the reliance of retail brokers on a bricks-and-mortar office network, personalized relationships between customers and brokers and customized advice and represents a significant departure from existing practices. However, critical advantages of incumbents, such as established brand reputations and customer relations, retain their value into the new market.

Key characteristics of online brokerage provide the context for this empirical study. First of all, entry barriers are low. Entry into the online brokerage area is mainly a decision motivated by strategic reasons, and not hampered by industry protection or technological capability issues. Amidst the e-commerce frenzy of the nineties, the emergence of online brokerage has attracted many new entrants to the industry. As of January 2000, more than 150 companies entered the online brokerage area, involving retail brokerage incumbents, start-ups, banks and technology providers. However, market uncertainties have been high, as highly diverging market projections testify. Thus, incumbents faced significant uncertainty about the impact of online brokerage, but their entry was generally not obstructed by technological limitations. Since its inception, online brokerage had a significant impact on the traditional retail brokerage industry. Industry reports claim that more than one third of retail brokerage trades are done online (Piper Jaffray, 2000). A significant number of incumbents entered during the measurement period. Finally, the development of online brokerage happened quickly, enabling a relatively short measurement window. Nevertheless, the data show significant variation. The high speed of change in the industry also calls for a dynamic approach in modeling competitive behavior.

The measurement sample of incumbents for this study consists of the 70 biggest retail brokerages as identified by the Securities Industry Association. These represent 82% of the entire industry. The

\(^2\) Resource heterogeneity across observations can also be accounted for by introducing a term for unobserved heterogeneity in the model (Chandrashekaran et al., 1999, Jain and Vilcassim, 1991; Vanhuele et al., 1995).

\(^3\) Because of the main interest and contribution of this study lies in investigating the contagion effect of incumbents' entry, the empirical context of the study is chosen to reflect these optimally, and reduce the confounding effect of pure technological capabilities. This excludes industries where the innovation decisions of firms are mainly determined by patent protection issues.

\(^4\) See Appendix 4.2 for more information about the online brokerage market and the data collection.
measurement window for this study covers quarterly data on the period 1996-2000. Of the total sample 44.3% have entered the online brokerage market in the period before January 2001.

The measurement window represents the growth stage of the market. Arguments for this choice are of theoretical and methodological nature. Given the analysis method, censoring of the data by limiting the measurement window does not cause any problem, under the condition that the choice of measurement window does not confound with important theoretical effects. This study’s focus is on competitive effects, which implies that I am interested in how the behavior and identity of previous entrants influences subsequent entry decisions. Only at the time when the industry is in the growth stage and several firms enter, this becomes relevant. The emerging and growth stages of a market differ in terms of market behavior and competitive behavior. It can thus be expected that entry decisions in both market stages are based on different dimensions and that the importance of these dimensions differs, which would harm the results from pooling the data points. Restricting the measurement window to the growth stage thus creates a more consistently behaving data set.

The dataset5 for the estimation contains 1045 discrete-time observations resulting from a maximum of 20 observations for 70 companies. Cases disappear because they enter the new market or because the company disappears from the risk set (mostly the company disappeared because it was acquired by another company). Right censoring occurs when an entry is not observed during the five-year measurement window.

7.2. Data Collection and Measures

Because innovations disrupt an existing industry, data on newly emerging markets are usually not available from conventional data sources. Critically important for this study is the presence of factual data that are not distorted by retrospective rationalizations. The alternative approach of surveying current managers suffers from memory and self-report biases as well as survivor biases. It would also lead to a cross-sectional instead of a longitudinal approach.

Data-collection for this study occurred by examining secondary data, following the principles of historical analysis (Golder, 2000). Historical analysis focuses on information issued at the time an event happened. This approach is very well suited for the chronological dimension that characterizes research on pioneering and market entry (Golder and Tellis, 1993). When, as in this study, the historical method is used to collect quantitative data, data-analysis does not differ from conventional approaches.

A database is constructed that contains longitudinal information on the development of the market, competitive entry and incumbent characteristics. The online brokerage market data consist of quarterly

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5 Appendix 4.3 contains the algorithm developed to compile the dataset for the hazard-model estimation based on the raw data files.
observations of the number of online brokerage accounts, compiled from market research and industry reports. This study uses account data rather than trading volume data because the latter are more likely to be affected by the fluctuations in the stock market. The number of online-brokerage accounts is also a good measure for customer adoption. It reflects the extent to which customers accept online brokerage. It also incorporates a long-term vision on expected revenues. Because an account generates revenues throughout its lifetime, the number of existing accounts is a good measure for market size.

The basis for the similarity measures is a similarity matrix that represents the similarity between all companies in the population. Conform to the competitive cognition literature, different similarity matrices between competitors are compiled, based on respectively the size, resource and market scope of the companies (Chen, 1996; Clark and Montgomery, 1999; Porac and Thomas, 1990). This distinction between three different similarity measures contains more information than one overall similarity measure and enables us to distinguish different effects of size similarity, resource similarity and market similarity. The similarity between two companies is contained between 0 and 1. One represents total equality, zero represents maximum dissimilarity. The similarity of an incumbent with the set of incumbents that have entered the online brokerage market is equal to the similarity to the entered incumbent most similar to the company. Compared to alternative measures, for example the average similarity to entered incumbents, this measure is most in line with the above-mentioned theoretical arguments for the similarity-effect, based on the motivation to respond to competitors, and the credibility, relevance and attention attached to their moves. The size-similarity measure captures the similarity between companies in terms of market share in the incumbent market. The market similarity measure captures the overlap in the geographical scope of companies. The resource similarity measure captures the organizational resources of the company. Because of the overlap between organizational processes and the product offered, typical for services industries, the organizational resources of the company closely reflect the positioning of the company in the retail brokerage market. This measure is also in line with the competitive cognition literature, which states that competitors are categorized mostly based on firm characteristics, and not on demand-based characteristics such as customer perceptions. The validity of the resource similarity measure is tested by correlating the resulting similarity matrix with other sources. The ability of this measure to discern different types of companies is reflected in the fact that it differentiates between the different types of brokerage firms identified by the Securities Industries Association. This confirms that these measures are industry-accepted and actually used to distinguish companies with a different positioning. Secondly, the similarity matrix is cross-validated with content analysis of industry publications in which similar sets of companies are mentioned. Appendix 4.1 contains additional details about the calculation of these similarity measures. All incumbent characteristics are based on figures from January 1996 and are treated as time-independent covariates. The choice for the start of the measurement window of the hazard model as the time to measure the company covariates allows for conformity between all cases (a later time would create a
problem with uncensored cases). Because of the limited change in these variables over time, treating them as constant over time creates no big violation.

Table 1 contains descriptive information about the dataset.
Table 1: Descriptive statistics and correlations

<table>
<thead>
<tr>
<th></th>
<th>Account</th>
<th>Accept</th>
<th>Bank</th>
<th>Shares</th>
<th>Simulates</th>
<th>Simulates</th>
<th>Simulates</th>
<th>Simulates</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>6.654</td>
<td>16.127</td>
<td>0.228</td>
<td>1.71</td>
<td>4.19</td>
<td>3.29</td>
<td>0.039</td>
<td>0.253</td>
</tr>
<tr>
<td>St. Dev</td>
<td>0.526</td>
<td>0.96</td>
<td>0.201</td>
<td>0.33</td>
<td>0.46</td>
<td>0.49</td>
<td>0.06</td>
<td>0.32</td>
</tr>
<tr>
<td>Growth</td>
<td>863.90</td>
<td>674.74</td>
<td>0.78</td>
<td>59.37</td>
<td>33.07</td>
<td>65.27</td>
<td>0.38</td>
<td>6.37</td>
</tr>
</tbody>
</table>

Note: The table includes descriptive statistics for various financial and market indicators, such as account balances, acceptances, bank accounts, and share statistics. The mean and standard deviation are provided for each category, along with growth rates and other relevant metrics.
8. ESTIMATION AND SPECIFICATION TESTS

The model is estimated as a discrete-time proportional hazard model with time-dependent covariates and a parametric baseline hazard function (Prentice and Gloeckler, 1987). The maximum likelihood estimation is based on quarterly data. Table 1 summarizes the data and table 2 reports the estimation results. A likelihood ratio test against an intercept-only model rejects the hypothesis that all parameters equal zero (p<.001). A series of nested models were estimated to determine the optimal specification of $\alpha(t)$. Likelihood ratio tests demonstrate that a constant term $\alpha$ is optimal. No violations against the basic assumption of proportionality of hazards were found (Allison, 1995). Additionally, the results remain robust when a proportional odds model is specified instead of a proportional hazard model.

Different model specifications are explored to assert the stability of the results across different measures of incumbent similarity. The discussion on specification of proportional hazard models centers on the assumed baseline hazard function and the impact of unobserved heterogeneity. Actually, these two issues relate to missing covariates that account for differences in two dimensions: (1) longitudinal and (2) cross-sectional. It has been argued that the inclusion and specification of an unobserved heterogeneity component is not as crucial as a flexible specification of the baseline hazard, particularly for single-spell data (Han and Hausman, 1990).

A nonparametric baseline allows consistent estimation of covariate effects for arbitrarily true underlying hazards (Vanhuele et al., 1995). In a first step, the parametric specification of the baseline hazard model I use is changed to a non-parametric specification, which does not require a decision on the nature of the duration dependence of the data. The non-parametric baseline hazard is a step function that can take on different values in each time interval. Taking into consideration that a sufficient number of events in a given time interval is needed to allow for reliable estimation of the associated parameters, a different baseline is allowed for every year of observations. The results of the non-parametric baseline models are included in the right-hand half of Table 2, and are consistent with the results obtained with the parametric specification. Seasonal dummies were added to test for heterogeneity of the parameter estimates of the baseline within the yearly time-intervals, but were found to be insignificant. Because the non-parametric baseline operates as a fixed time-effect, the model can no longer incorporate covariates that only vary over time. At the same time, this implies that the nonparametric baseline incorporates all the changes in the market over time that can influence the probability that an incumbent enters the market. These may be related to the market characteristics (e.g. market profitability, adopter characteristics, etc.) or the characteristics of new entrants in the market (e.g. scale and performance of new entrants, number of entrants, etc.).
Besides the baseline hazard specification, failing to account for unobserved heterogeneity could possibly lead to biased hazard estimates. Unobserved heterogeneity tends to produce estimated hazard functions that demonstrate negative duration dependence, even when the true hazard is not declining for any observation in the sample (Heckman and Singer, 1985; Allison, 1995). The non-occurrence of a negative duration dependence in my model is insufficient to rule out that unobserved heterogeneity issues are not present. Following Hamerle (1990), the model was tested for unaccounted heterogeneity. The test-statistics are not significant, confirming that unobserved heterogeneity does not interfere with the above results.

To verify if the possible residual correlations could affect the parameter estimation, an additional analysis was carried out using a GEE approach. This allows for a correlation between discrete-time data-points from the same observation, and thus takes into account the error dependence between discrete-time data-points. The estimated correlation are very low. This again confirms the lack of an effect due to unaccounted covariates and reassures the robustness of the results.

9. RESULTS

The parameter estimates, shown in Table 2, demonstrate that market effects, specifically, market growth, as well as competitive effects, represented by incumbent similarity, determine the timing of an incumbent’s entry into a new industry subfield. The first hypothesis in this research addresses whether an incumbent’s entry is positively affected by the entry of similar companies. It could easily be the case that the more similar a competitor that enters the market is to a firm’s own characteristics the less likely the firm itself is to enter, given it has been “preempted” and has little to bring to the market. Interestingly, I found the opposite. I used three different measures of incumbent similarity. I used these in three different models because of their high inter-correlation (Table 1). For the similarity in terms of size and in terms of resources, the higher the competitor similarity, the more likely the incumbent was to follow into the new market (p<.05). This was not the case for the similarity of the market they served, perhaps because of the preemption concern, although there was no significant effect in any direction. This supports the proposition that incumbent entry is positively affected by the entry of similar incumbents.

The second hypothesis, H2, regarding the salience of the competitor, did not prove to be significant. Several possible explanations could account for that. First, the employed salience measure may not have captured the true perceived salience of the competitors. Second, the measure may not have shown enough variation to reflect a significant effect.

The last hypothesis, H3, states that the likelihood of incumbent entry is positively related to the growth of the market. The obtained parameter estimate was borne out to be significant (p<.05).
<table>
<thead>
<tr>
<th></th>
<th>Parametric Baseline Models</th>
<th>Non-parametric Baseline Models</th>
</tr>
</thead>
<tbody>
<tr>
<td>Year 1</td>
<td>- 0.6798</td>
<td>- 1.1675</td>
</tr>
<tr>
<td>Year 2</td>
<td>- 1.1194</td>
<td>- 1.3687</td>
</tr>
<tr>
<td>Year 3</td>
<td>- 1.4653</td>
<td>- 1.4465</td>
</tr>
<tr>
<td>Year 4</td>
<td>- 0.2425</td>
<td>- 0.1574</td>
</tr>
<tr>
<td><strong>Market characteristics</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Growth</td>
<td>0.0007*</td>
<td>0.0009**</td>
</tr>
<tr>
<td><strong>Salience of Incumbent entry</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Salience</td>
<td>- 0.0249</td>
<td>- 0.0395</td>
</tr>
<tr>
<td><strong>Similarity with entered incumbents</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>size similarity</td>
<td>3.0497*</td>
<td></td>
</tr>
<tr>
<td>resource similarity</td>
<td>2.3058**</td>
<td></td>
</tr>
<tr>
<td>market similarity</td>
<td>0.4258</td>
<td></td>
</tr>
<tr>
<td><strong>Company Covariates</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>States</td>
<td>0.0462***</td>
<td>0.0445***</td>
</tr>
<tr>
<td>Bank</td>
<td>0.2400</td>
<td>0.5047</td>
</tr>
<tr>
<td>Accounts</td>
<td>0.1987</td>
<td>0.0397</td>
</tr>
<tr>
<td>Offices</td>
<td>- 0.0033***</td>
<td>- 0.0020*</td>
</tr>
<tr>
<td>Rettot</td>
<td>4.6992**</td>
<td>3.1722*</td>
</tr>
<tr>
<td>Accoff</td>
<td>5.8889</td>
<td>12.4910</td>
</tr>
<tr>
<td>Accrep</td>
<td>0.0014***</td>
<td>0.0012***</td>
</tr>
<tr>
<td>Error correlation (GEE Model)</td>
<td>- 0.0008</td>
<td>- 0.0010</td>
</tr>
</tbody>
</table>

**Table 2**: Discrete-time hazard model estimation

Significance tests are bases on likelihood ratio chi-square statistics (***: p < .01; **: p<.05; *: p<.1)
The estimation of the model demonstrates that the difference in timing between incumbents' response is not predetermined by the companies' characteristics, but depends on other companies' actions. The results confirm that incumbents are more likely to respond to innovations in their industry when their similar counterparts do so.

Many of the company covariates, but not all that I tested, turned out to be significant and in the logical direction. They confirm that incumbents' response to technological innovation is influenced by its position, reflected in its product and market positioning, structure and size (King and Tucci, 2002). For example, the more geographical markets a firm is present in, the more likely (p<.01) it is to respond. This is probably because of the economies of scale from which they could operate. And, the more there was a retail customer base in the existing business (rettot) the more likely was the firm to enter into the new technology (p<.01).

The results also indicate factors that slow down the reaction of incumbents to technological innovations that create a new industry subfield. Consistent with the existing literature (Ghemawat, 1991; Tripsas, 1997), the existence of specialized resources that were invested in the incumbent market is a source of inertia. The more a company has vested resources tied to the existing technology, the more it will be reluctant to potentially obsolesce these by entering into the new market area. This is apparent in my results in the significant negative effect of the number of bricks and mortar offices (offices). Besides these physical resources, human resources invested in the incumbent market also create inertia. The more personalized the customer relationship (as represented in a lower number of customer accounts per account representative, measured by the variable accrep) the slower the company responded to the emergence of online brokerage (p<.01).

10. DISCUSSION

Most studies of competitive responsiveness look at one firm and its likelihood to respond to the actions of its competitors. In this study I looked across an industry and at its evolution of competitive response to entry. The central question of this research focuses on incumbent entry in a new market niche created through technological innovation. It is often easy for the incumbent to ignore the new technology, as too much inertia is already invested in the market and the way it is currently being served. There are invested resources that may not be fully amortized. Hence, companies like Merrill Lynch having a large sales force and many retail offices may be reluctant to enter into the online brokerage market, or the existing phone companies may be hesitant to switch customers from landline service to cellular service, or evolve from analog to digital switches. And, with any new technology or subfield of a market there is risk. So, the question is what leads an incumbent in a market to enter into the new technology? What are the factors which drive this decision and when? I believed, and found, it was in part related to the
attractiveness of the new market and the characteristics of those that did enter. The empirical investigation presented in this chapter contributes to the existing literature in several ways. It allows us to take the literature one step further in identifying the determinants of an incumbent's reaction to competitive innovation. The generality of my model is instructional on how first-movers can infer the speed at which they are copied.

The presented approach moves away from a deterministic view that explains incumbent reaction based on the company and the innovation's characteristics. Instead I introduce a path dependency into the entry decision by incorporating asymmetric and dynamic competitive effects. The impact of individual competitive behavior (instead of general characterizations of the level of competition in the market) has not been addressed in previous studies on entry decisions or competitive reaction to innovation. Additionally, this study uses a longitudinal view to investigate evolutions of an industry as a result of innovation. This contrasts with the prevalent cross-sectional approach of innovation research.

There are, of course, several caveats to note, or opportunities for future research. The analysis of intercompany influence was limited to past behavior only. I thereby ignored contemporaneous and anticipated future reactions. I was limited in the measures that I had about the attractiveness of the market, which would have been helpful to further explore which market factors expedite entry. Also, it is important to note that my results are not intended to convey normative implications about the appropriateness of contagion in market entry. Rather, this chapter carries managerial implications that relate to the assessment of expected post-entry competition. Previous research showed that companies base entry decisions on static expectations of competition and fail to make accurate conjectures about the future competitive presence. My results demonstrate the bias this causes, because the entry of the company precisely induces similar counterparts to do the same.

Previous studies have demonstrated that performance is related to early or late entry more than to the actual order of entry (Mitchell, 1991). In other words, especially in fast evolving markets, it is not so much important to be first, as it is to be one of the first (Bayus et al., 1997). Early market followers that are willing to commit adequate resources to a new market stand the greatest chance of winning the market (Golder and Tellis, 1993). Pioneer advantages are thus contingent on the quality and speed of followers. Because incumbents possess existing assets that advantage them to successfully market innovations, their entry time is of critical importance. This study is the first to concentrate on the impact of competitive effects on incumbent's response to innovations. It does so by distinguishing between the effects of opportunity and between-competitor influences. My results contradict the endeavor for pre-emptive entry and suggest that companies do not respond pro-actively to the emergence of a new field. The results suggest that the entry of competitors with a similar resource base increase the sense of urgency to respond to a new field in the industry. The entry of an incumbent in a new industry subfield thus
qualifies as a response to a growing market, as well as a response to competitors. The results of this study are most consistent with the behavior of many industries in the late 1990's with a reluctance of many incumbent firms to enter the dotcom fray of their industries until many of their competitors also entered. The apparent growth of the market and the fear of being left behind was too tempting to withhold entry.

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CHAPTER 5

Conclusion and future research agenda

1. INTRODUCTION

This dissertation presents three different essays that deal with research questions concerning the response of companies to competitive innovation. Chapter 1 outlines the theoretical foundation on which the three essays are built. Chapter 2 investigates the impact of a company's launch strategy on the occurrence of competitive reaction. Chapter 3 introduces the concept of new product assessment and establishes its mediating role in explaining competitive reaction to new product introductions. Chapter 4 looks at the response time of incumbents to the emergence of a radical innovation that creates a new industry area. This chapter wraps up the findings from the preceding chapters. I discuss each study separately. Each section starts with a short summary of the most important findings of the study. Next, I highlight the empirical, methodological and theoretical contribution. Finally, managerial implications of each paper are discussed. This overview of the three studies presented in this dissertation serves as a content-summary that can be read separately from the individual chapters.

This chapter also relates the obtained findings back to the theoretical schools of thought introduced in Chapter 1. I discuss the integration of this research' findings within these theoretical frameworks. The chapter concludes with an outlook on a future research agenda that builds upon the findings presented in this work.
2. SUMMARY

2.1. The impact of new product launch strategies on competitive reaction (Chapter 2)

2.1.1. Summary of findings

The study presented in chapter 2 conforms to the existing research tradition of empirical studies that look at competitive reaction to new products. The dominant approach of these studies is to explain competitive reaction using cross-sectional surveys of either the innovating or reacting firm (see for example: Robinson (1988), Bowman and Gatignon (1995), Gatignon et al. (1997), Kuester et al (1999)). This chapter adds to this literature by focusing on the marketing strategy employed by a company that introduces a new product on the market. This new product launch strategy is assumed to influence the occurrence and nature of competitive reaction. The theoretical basis for the hypothesized effects originates from two lines of reasoning. First, reaction stems from the threat that a new product represents to the competitive position of a company. Second, the occurrence of competitive reaction is also influenced by information processing within the reacting firm. This, for example, implies that new product introductions that draw a lot of attention and of which the competitive threat is easily interpretable are more prone to competitive reaction.

The data stem from a survey of companies that introduced a new product. This survey was executed in the Netherlands, the UK and the US and resulted in information about 509 new products introduced by 316 companies. The influence of the new product launch was analyzed by a logistic regression on the occurrence of competitive reaction with any marketing mix instrument. A poisson regression was executed to investigate the occurrence of multiple instrument reactions.

The results show that 63.1% of new products meet competitive reaction after their launch. Price modifications prevail (43.6%), closely followed by changes in product assortment (35.5%). While changes in marketing communications also occur rather frequently (23.9%), my data show that changes in distribution in response to a new product launch were rather rare (3.2%). Almost half of all reactions manifested itself only in one marketing instrument.

The characteristics of the new product launch strategy were found to have a significant impact on both the occurrence and nature of competitive reactions. I claim that the competitive effect of radically new products and incrementally new products differs greatly. Radical innovations are less likely confronted with competitive reaction than new product introductions that fit within the confines of an established product definition. If reaction does occur, it is most likely on the product dimension. Competitors do react if a new product can be assessed within an existing product category and thus
represents an unambiguous attack. Both innovative and imitative new products meet reaction in this case.

Competitors also react less to products whose positioning does not directly threaten their existing target markets. This implies that products that are targeted at niche markets meet less reaction. On the other hand, if a product is highly supported with marketing efforts, or it is launched within a growing market, competitors will most likely respond.

2.1.2. Contribution to the Literature and Research Implications

This research contributes to existing empirical work that makes the connection between the introduction of new products and the subsequent reaction by competitors. Previous empirical research suggests that the occurrence of competitive reaction to new products is influenced by the characteristics of (1) the new product itself (Kuester et al., 1999; Waarts and Wierenga, 2000) and also by (2) the market context (Kuester et al., 1999; Ramaswamy et al., 1994; Shankar, 1999), (3) the innovating firm (Bowman and Gatignon, 1995; Shankar, 1999; Waarts and Wierenga, 2000) and reacting firm (Bowman and Gatignon, 1995; Kuester et al., 1999; Robinson, 1988; Shankar, 1999). The main contribution of this article lies in the examination of the impact of the characteristics of the new product launch. This adds to the increasing amount of literature on new product launch strategy (Gatignon et al., 1990; Hultink et al., 1997 & 2000; Yoon and Lilien, 1985).

The applied research methodology is in line with the above-mentioned articles. The data are based on a mail survey with companies that introduced a new product. The empirical contribution from this paper stems from the fact that data were collected in three countries.

The results, discussed in the previous section, add to the extant knowledge about competitive reaction to new products. However, the results of this study also raise a number of issues that are addressed in the following two papers included in this dissertation. First, this study does not differentiate between competitors. In assessing competitive reaction, the competition is lumped together. This means that this paper fails to address the heterogeneity in reaction between competitors. This does not recognize the dyadic nature of competition.

Second, the results stem from a correlational framework that links competitive reaction directly to the competitive action. This approach creates valuable conclusions about the determinants that give rise to competitive reaction. However, it is often not helpful in producing insight in the decision process that creates a certain response by competitors. Chapter 3 concentrates on this issue by explicitly looking at the new product's assessment by competitors.
Third, the results create interesting insights in the difference in reaction between radically and incrementally new products. Whereas innovative new products that fit the framework of existing products encounter competitive reaction, radical new products are less likely responded to. This supports the notion that incumbent companies fall prey to inertia when confronted with radical innovation. It agrees with the observation in the innovation literature that radical innovation often originates from industry outsiders and that existing firms experience difficulties in dealing with radical change in their industry. The paper in Chapter 4 of this dissertation further deals with this issue.

2.1.3. Managerial Implications

2.1.3.1. The need for a competitor orientation in new product launch

This study demonstrates that it is important for managers to take into account that their competitive environment is \textit{not a static one}. Two thirds of new products meet some reaction by competitors. In thinking about a new product introduction, managers should consider that competitors are likely to respond to their actions. This implies that the effectiveness of their marketing actions depends on the residual effect that remains after competitive reaction has been factored in. Consequently, improving a new product's success rests with the ability of the firm to implement a strong competitor orientation before and during the launch. Launch strategies ought to include a conjectural plan, integrating competitive reactions. This enables the company to develop detailed scenarios that provide a means to be prepared for different competitive situations.

Nevertheless, competitive decision making proves to be difficult in practice (Urbany and Montgomery, 1998). Companies experience difficulties to step into their rivals' shoes to predict their reaction behavior (Zajac and Bazerman, 1991). Understanding the antecedents of competitive reaction is a necessary prerequisite to better understand and predict competitors' behavior. The study presented in this article responds to this need. Anticipation of competitive reaction can substantively improve managerial decision-making, but depends on an insight in the effect of the company's moves on competitors.

2.1.3.2. Actions that lead to reaction

I found that the likelihood and nature of competitive reaction is significantly influenced by the actions of the innovating company. Thus, the strategic decisions managers make concerning a new product launch already instigate future reactions by competitors. Consequently, the likelihood of competitive reaction may deliberately be directed by the innovating firm through the choices they make in the launch strategy. Companies can employ different strategies to avoid competitive reaction. My results suggest that in order to execute this effectively, one should consider the centrality and scale of attack the new product
introduction means for competitors. All actions that directly confront competitors make them respond to defend their market position. This implies that it requires deep pockets to successfully introduce a new product that is a clear-cut attack on existing competitors. Companies that plan to introduce a new product that carries any of the following characteristics should be prepared for that:

(1) the product is a direct imitation of an existing product
(2) the product represent a significant innovation within the boundaries of an existing product category
(3) the product receives significant promotion efforts
(4) a selective targeting strategy is employed
(5) the product is launched into a growing market

New product introductions that happen more out of the limelight are more likely to escape competitive retaliation. This implies that this is a more appropriate strategy for companies that lack the resources to survive a head-on confrontation with existing competitors in the market. New products that have the following characteristics fit within this category:

(1) the product is a radical innovation
(2) a niche strategy is employed

If the new product introduction does not directly targets competitors’ territory, it is less likely reacted to. This can be caused by the fact that these new products do not constitute a direct obvious attack, and are recognized so. But it can also been caused by the fact that less attention is paid to such new product introductions. It was found that the probability of reaction was positively related to launch tactics that enhance the visibility of the launch. Actions that do not alert competitors towards the new product introduction result in a smaller chance of competitive reaction. I have found that investments in distribution do not lead to more competitive reaction. Thus, launch tactics that occur out of the view of competitors are more beneficial if one wants to avoid retaliation.

Obviously, there exists a tension between optimizing the success probability of a new product and at the same time attempting to avoid competitive reaction. For example, a new product that is introduced in a declining market and is not heavily sustained by marketing efforts is more likely to escape competitive reaction. But these choices also decrease the performance of the new product. The most useful recommendations are based on launch strategy characteristics that improve the new product’s performance, but not increase competitive retaliation. For example, increased investments in distribution do not cause competitive reaction, in contrast to promotion investments. This suggests that less deep-pocketed companies are served better from applying a push strategy than a pull strategy.
2.1.3.3. Shaping the competitive arena

Overall, the results of this study support an avoidance strategy in order to escape competitiveness. Instead of confronting competitors with head-on competition, an avoidance strategy seeks to bypass competitors. This strategy is particularly useful for small companies that compete with large established firms (Yoffie and Cusumano, 1999). As they cannot win the competitive game by utilizing extensive resources, they have to find more creative ways to change the rules of the game and establish a less mainstream position in the market.

The results from this study indicate that companies that seek particular niches or launch radical innovations are confronted less with competitive reaction. On the other hand, companies that introduce incremental innovations into existing markets and attack existing segments follow established rules of the game and will therefore confront competition. However, companies that want to avoid competitive retaliation should consider abandoning this dysfunctional competitive focus that leads them to invest in incremental improvements (Kim and Mauborgne, 1997). In spite of the undoubted importance of incremental innovation within existing product categories (Banbury and Mitchell, 1995), companies must realize that they directly confront competition by doing so. Companies that break the established logic of the market, and change the rules of the game, create a position that is difficult for incumbents to get a grip on and escape competitive retaliation.

2.2. Competitive responsiveness versus inertia: The liability of success (Chapter 3)

2.2.1. Summary of findings

This study zooms in on the reaction decision process that leads to competitive reaction to new products. It starts from the premise that managerial assessment is a key component in a company’s strategic response to environmental events and should be included as a mediating factor that provides the link between external events and organizational response. It is demonstrated that decision makers’ assessment of a competitive new product introduction contains a motivational component and a feasibility component. The motivational component expresses the urgency decision-makers feel to respond to a competitive new product introduction. The feasibility component expresses the extent to which decision-makers feel they are capable of mounting a response. The new product assessment concept is embedded within a conceptual framework that clarifies its role in the reaction process. This framework puts new product assessment in a mediating role. Its antecedents consist of external factors (describing the competitive new product introduction) and internal factors (describing the market position and resources of the reacting company). As such, it is recognized that the competition between two companies cannot be expressed solely by looking at the competitive new product introduction. It also depends on the
resource position of the company confronted with the new product. External and internal factors both influence companies' assessment of a competitor's new product introduction.

The Markstrat market simulation provides the empirical context of this study. The data combine business performance and decision data provided by the market simulation with self-reported measures. The self-reported data measure the assessment of a competitive new product introduction. The market data and self-reported data are combined within a structural equation model. Given the multilevel structure of the data (because of the repeated administration of the self-reported measures by the participants), a multilevel structural equation model is applied.

The results show that new product assessment affects competitive reaction and that it mediates the relationship between the competitive new product introduction and competitive reaction. Three elements of new product assessment are identified. The perceived centrality of attack of the new product expresses the extent to which the new product is perceived to be targeted at the company's market. The perceived potential performance of the new product expresses the impact of the new product on the market. The perceived feasibility to react expresses the degree to which the decision-maker believes the company can effectively respond.

The results demonstrate that the inclusion of new product assessment creates additional insight in the determinants of competitive reaction. The new product embodies changes in the market environment that create pressure on other companies. The retarding force of inertia within the organization counterbalances the motivation to react that arises from this competitive pressure. In particular, it is shown that success creates inertia because successful companies are less motivated to respond to competitive new product introductions. My results add to the unresolved debate about the influence of the market position of the company on its propensity to react. This paper shows that the discussion may be caused by a lack of insight in the different effect that the success of the company has on its motivation and capability to respond to competitive new product introductions. Successful companies possess a larger capability to react to competitors' moves but are less motivated to do so.

The results also demonstrate that decision-makers take an inward perspective to assess the company's ability to deal with the competitive challenge posed by the new product introduction. The perceived feasibility to react is influenced by the company's resource position. The resources the innovating company invests in the new product launch do not significantly affect it.
2.2.2. Contribution to the Literature and Research Implications

This paper adds to the existing literature theoretically, empirically and methodologically. The theoretical perspective stems from the desire to gain new insight in the cognitive process that leads a company to respond to a new product introduction. The scanning-interpretation-action paradigm, developed in organization research to study organizational change, provides the theoretical basis. This differentiates this work from previous studies on competitive reaction to new products because it does not treat the organization as a black box. Instead, it takes an explicit focus on how competitors interpret events and how this affects their response to it.

Although it has been acknowledged that products that are interpreted as a greater threat are more likely reacted to, little is known about this assessment process (Klemz and Gruca, 2001). I develop a conceptual model for new product assessment. A better understanding of the antecedents of competitive reaction originates from looking at how these antecedents impact the different dimensions of new product assessment. In particular, I provide empirical evidence for the hypothesis that success causes competitive inertia. This liability of success hypothesis, which is grounded in the behavioral theory of the firm, states that successful firms underestimate the impact of their competitors' moves and therefore remain complacent. Recent research has shown increasing interest in the phenomenon of competitive inertia, in particular in its relationship to companies' innovation decisions (Chandrashekaran et al., 1999; Kuester et al., 1999). However, the current research lacks specificity about the roots of competitive inertia and the processes through which these impact a company's actions. Additionally, there is a need for empirical evidence that demonstrates the existence and nature of competitive inertia.

I also complement the usual focus of the new product reaction research on the threat a new product represents with a perspective on the capability of the company to respond. Traditionally, empirical research is based on the presumption that reaction to new products stems from the extent to which the new product challenges the company's market position. This is in line with the competitive positioning school (grounded within industrial organization economics), but largely ignores the resource base of the company as a decisive factor that influences its strategic choices. The current study demonstrates that the existing motivation-focused approach should be complemented with a capability approach. Because the results demonstrate that the perception of feasibility to respond to competitive pressure is largely determined by the resources of the company (as opposed to external determinants represented by the competitive action) this emphasizes the heterogeneity in response between competitors. This encourages additional research that takes a resource-based perspective and explains heterogeneous reactions from different competitors on the basis of their different resource base.
Empirically, this study differentiates itself from the stream of research that relies completely on retrospective reports about competitors' reaction to new products. Aside from the potential hindsight biases that may distort the findings, this approach blurs the distinction between the actual event and the respondent's assessment of that event. Because of that, there has been a tendency to confound the attributes of a new product introduction with the process of interpretation. However, interpretation involves giving meaning to an observed, objective event, and is colored by the organizational context. Thus, it is important to differentiate the objective characteristics of a new product introduction from its interpretation. The empirical results presented in this paper stem from multiple-source data. The data explicitly make a distinction between factual information about the new product and perceptual measures about its assessment by competitors. Additionally, the real-time administration of new product assessment is a promising path for other research. It alleviates the potential biases that arise from retrospectively recording new product assessment.

Methodologically, I extend current practice by introducing a multilevel structural equation model. Structural equation modeling has become a widespread practice, thanks to its flexibility in estimating multiple-equation linear models and its ability to combine measurement and structural models (Baumgartner and Homburg, 1996). Structural equation modeling is recognized as a powerful methodology to capture complex models. Additionally, it permits the researcher to rigorously assess the validity and reliability of the measures. When the data have a multilevel structure (e.g. observations from groups, panel data) the structural equation model has to be adapted to take into account the dependence between observations. Statistical literature has discussed structural equation models for multilevel data, but this method has not yet been widely adopted in the marketing literature (Muthen 1994; Kaplan and Elliott, 1997).

2.2.3. Managerial implications

First, the results of this study show some interesting implications for companies planning to introduce a new product. The results are in line with the results from Chapter 2. They corroborate the previous finding that the new product's launch strategy affects competitive reaction. New products that are targeted at competitors' markets and that are highly sustained stand a greater chance of being retaliated. I show that these products create a higher urgency to respond because they are perceived as a direct attack that has a significant impact on the market.

I also demonstrate that companies should be cautious about attempting a deterrence strategy by aggressively promoting their new product. Because competitors mainly rely on internal aspects to assess their feasibility to respond, this is likely not to discourage competitors.
Previous research showed that challengers often dethrone market leaders because they remain too passive to their competitors' actions (Ferrier et al., 1999). Market share erosion results from being too self-contended and not aggressive enough. Smaller players on the market may not have the resources at hand that market leaders have, but they have a more aggressive competitive posture. The results presented in this study confirm and explain this phenomenon. They demonstrate that successful companies should take explicit action to boost competitive vigilance and to enhance the perceived urgency to respond to competitive moves.

2.3. Incumbent entry in new markets: Empirical evidence of contagion (Chapter 4)

2.3.1. Summary of findings

This paper investigates the reaction of incumbent firms to the emergence of technological innovations. Often, radical innovations do not represent a direct attack to the existing business of incumbents, but create a new market within the industry. The decision of incumbents to enter this new market niche is the focal issue in this study. The research questions are: What determines when incumbents enter into a new market niche? Can we explain the heterogeneity in timing of incumbents' response by looking at the effect of other incumbents' entry into the new market?

The major interest of this study is how the identity of other entrants influences the decision of a company to enter a new emerging area. Specifically, I suggest that companies not just react to a new market, but that their behavior is also influenced by how their incumbent competitors act. This paper claims that a contagion effect exists between incumbents' entry. Contagion is defined as a process whereby each adoption of a new practice or product makes the subsequent adoption of a potential adopter more likely (Burt, 1987). The term has mainly been used in reference to consumer adoption of innovations. Extending this analogy, I look at a company's entry decision as an adoption decision. Similar to consumers' adoption decision, I expect this entry decision to be influenced by the preceding entry of other companies. Competitive cognition research claims that companies envision a limited number of similar companies, and that it is mainly the behavior of these competitors that influences them. By imitating their moves, existing competitive frameworks are reinforced. This suggests that the entry of similar competitors in the new industry subfield increases the probability that a company also enters.

I developed a hazard model for incumbent entry into this new market. This model incorporates three forces that influence when companies enter: (1) The growth of the new market, (2) the contagion effects caused by other incumbents' entry, (3) the effect of incumbent characteristics that influence their propensity to enter the new market.
The empirical context of this study is the retail brokerage industry. In the mid-90's, this industry was confronted with the emergence of online brokerage. The data for this study cover a five-year period. The empirical model investigates the timing of entry of incumbent retail brokerage firms in the new area of online brokerage. The specified model is a proportional hazards model, with a parametric baseline hazard and time-varying covariates. The parameter estimates demonstrate that market effects as well as competitive effects determine the timing of an incumbent's entry into a new industry subfield. This paper shows that incumbents are more likely to respond to innovations in their industry when their similar counterparts do so. This confirms that the difference in timing between incumbents' response is not predetermined by the companies' characteristics, but is contingent on other companies' actions.

2.3.2. Contribution to the Literature and Research Implications

This study introduces the concept of contagion within a competitive setting. The results suggest that incumbents are triggered by their similar counterparts' entry in new industry areas to follow suit. Recent research has investigated imitation processes between organizations (Haunschild and Miner, 1997; Haveman, 1993; Kraatz, 1998; Greve, 1998). This is the first study to address this issue in the context of market entry and concerning competing organizations. The initial results presented in this study trigger new questions about the roots of the detected contagion effect, and the context in which it holds up. The arguments I made are based on two theoretical perspectives. The contagion effect can be defended from the perspective of resource-based competition (Narasimhan and Zhang, 2000). At the same time, arguments for a contagion effect can be made from a decision-theoretic perspective, based on the attention, relevance and credibility attached to competitors' actions. Additional research is needed that investigates the decision process that lies behind the apparent contagion effect and disentangles different motivations that lie behind it.

Also, the contagion effect could be contingent on other factors. For example, it could be a time-dependent effect. It could be argued that entry contagion is a phenomenon that is constricted to the growth stage of the market, but disappears in the mature stage when uncertainties fade and the competitive battlefield becomes more established. Furthermore, it would be useful to know if previous entrants can manipulate the contagion effect that their entry prompts. In other words, is the contagion effect contingent on competitors' behavior? This question relates to the idea that market evolution and competitors' behavior are interconnected (Gatignon and Soberman, 2001).

The approach used in this paper moves away from a deterministic view that explains incumbent reaction based on the company and the innovation's characteristics. Instead we introduce a path dependency into the entry decision by incorporating dynamic competitive effects through a contagion effect. The impact of individual competitive behavior (instead of general characterizations of the level of competition in the
market) has not been addressed in previous studies on entry decisions or competitive reaction to innovation. Additionally, by applying a hazard model with time-dependent covariates, this study uses a longitudinal view to investigate the evolution of an industry as a result of innovation. This contrasts with the prevalent cross-sectional approach of innovation research.

This study also empirically contributes to existing research by building up a unique data set. Data-collection for this study occurred by examining secondary data, following the principles of historical analysis (Golder, 2000). Because innovations disrupt an existing industry, data on newly emerging markets are usually not available from conventional data sources. Critically important for this study is the presence of factual data that are not distorted by retrospective rationalizations. The alternative approach of surveying current managers suffers from memory and self-report biases as well as survivor biases. It would also lead to a cross-sectional instead of a longitudinal approach.

2.3.3. Managerial implications

This study provides valuable insights in the way incumbent companies respond to a radical innovation. It shows that the entry of similar incumbents prompts others to follow. In other words, a company is more likely to enter a new area when similar counterparts do the same thing. This demonstrates the strategy convergence that happens between similar companies. Three important implications can be drawn from that. First, incumbents should not expect that advantages in line with spatial competition can be expected from moving first. In other words, they cannot occupy a position in the new market (based on their existing resources) and expect a deterrence effect from their mere presence. In fact, they attract competition by their entry in the new market. The market entry plan should take into account this post-entry change in competition.

Second, the expectation of increasing competition from similar counterparts can change the optimal entry time for incumbents. The flood of incoming incumbents causes a rapid development of the new market and increases the competition within the market. The former accelerates the cannibalization on the existing market whereas the latter makes the new market less attractive. These considerations decrease the expectation of positive gains from entering the new area, and thus should delay entry.

Third, incumbents should also consider different approaches to avoid the attraction of competition in the new market. For example, this could be realized by entering the market through acquisition and operate it as a separate unit. This sends a weaker signal to competitors because it causes fewer disturbances within the organization. Also, it reduces the learning effect for competitors because they cannot make inferences about their own entry from this move. In other words, the acquisition entry has less diagnostic value for competitors. Of course, this advantage should be balanced against the financial sacrifice and the loss of utility from complimentary assets that retain their value in the new market.
This study shows that companies predominantly respond to competitive pressure from their similar counterparts. This confirms that decision-makers focus attention on the competitors that they perceive to be part of their strategic group (Porac and Thomas, 1990). This leads to convergent behavior between these companies, reinforcing their categorization in similar cohorts. As a consequence, companies remain trapped within the same competitive situation, primarily competing against companies with the same resources, history and positioning. Escaping this competition requires a broader scope and vision within the company’s competitive analysis. In order to avoid competitive myopia decision-makers should actively and explicitly broaden their scan.

My results show that the balance between the outside competitive pressure and the retarding forces within the organization influences the response time of different incumbents. Being an industry incumbent could be an important source of competitive advantage over new entrants in the new market. But, incumbents’ organization is construed to perform in the existing incumbent market. Existing routines are not easily adaptable. The financial and human investments in the incumbent market create a barrier to switch gear. The existence of an established organization thus only retards the entry of an incumbent in new areas. The financial, organizational and marketing advantages of incumbents could be leveraged in the new area, but instead they slow down the change. An opposing force against this mechanism is the entry of other incumbents in the new market. This creates competitive pressure to follow suit. It is the trigger that causes incumbents to move into new areas.

This suggests that newcomers to the market have certain advantages. In comparison to incumbents, they can build up an organization from scratch and adapt its characteristics to suit the new market. There is no established structure to resist the change. Also, newcomers can look at the new market from a pure opportunity perspective. Incumbents factor in the possible losses to their existing business and thus have a different investment calculation to make. Because of that, the emergence of radical innovations is an opportunity for new entrants to encroach on the market (Han et al., 2001).

This indicates that established companies that want to remain at the forefront of innovation in their industry benefit from doing that within separate organizational structures. This alleviates a number of concerns that may be the cause of inertia. The absence of established organizational routines and existing commitments to the incumbent market eases the transition.
3. DISCUSSION

3.1. Five schools of thought

In Chapter 1, five different schools of thought on the study of competition were introduced.

1. Industrial organization economics, on which the positioning school advanced by Porter (1980) builds, emphasizes that competition is determined by industry structure. The main task of a company is to seek a defensible position in an attractive market, deter competition and erect entry barriers by credible commitments, signals and pricing strategies.

2. Strategic conflict theory uses game theory as a method to investigate company performance as the result of a cascade of moves and countermoves. The main task of the company is to make accurate conjectures about competitors' actions under different circumstances and optimize their actions accordingly. Obviously, this hinges on the ability of decision-makers to delineate the competitive game and identify decision alternatives available to competitors.

3. Theories about resource-based competition assume that performance is the result of the development of inimitable resources and capabilities that create a sustainable competitive advantage. At the heart of the company's strategic decisions is not the search for attractive market environments (as dictated in the industrial organization perspective) but the firm's ability to exploit its distinctive resources and capabilities (Wernerfelt, 1984).

4. The behavioral theory of the firm underscores that a company's strategic decisions are the result of information processing by bounded rational human beings. Central to the understanding of competitive behavior is the way decision-makers build knowledge structures of their environment, and the resulting scanning and interpretation of external information.

5. As applied to the study of organizations, population ecology theory provides a supply-side theory of market evolution that takes into account the evolution in competitive intensity (Lambkin and Day, 1989). Population ecology models specify the process at which the population of suppliers grows. A central understanding is that the population of suppliers grows proportionally to the difference between the present population size and the equilibrium level population size (Hannan and Freeman, 1977).

These five different theoretical perspectives each stress different issues as the prime determinants of companies' competitive behavior and performance. It is important to recognize that in spite of their differences they are complimentary and not antagonistic views. The industrial organization, game theory and population ecology view take a primarily external perspective while the resource- and behavioral-based view are more internally oriented.

The three papers presented in this dissertation borrow from each of these different theoretical perspectives on competition. Overall, the conceptualization is predominantly based on an integration of
behavioral perspectives and resource- and positioning-based competition. The literature review in each paper and the arguments that are developed to legitimize hypotheses are based on findings from each school of thought.

The following sections relate the papers within this dissertation back to each school of thought. I discuss the extent to which the obtained results are in line with the fundamental premises of each paradigm. I also discuss implications for research within each research stream.

3.2. Industrial organization economics

The results from each study confirm the notion that a market's structural attractiveness and the positioning of a firm within that market are crucial determinants of a company's competitive behavior. Chapter 2 shows that companies react to new products in a growing market. Chapter 4 demonstrates that a growing market is a primary determinant to explain incumbent's entry in new industry areas. Chapter 2 and 3 both prove that competitive reaction results from competitive moves that attack a company's position in the market, either through the directness or aggressiveness of the move.

At the same time, a number of issues can be raised with respect to the evaluation of a market's attractiveness. This becomes increasingly difficult when the market's boundaries and hence the identification of a firm's position within it are no longer clear. Innovations, in particular radical innovations, can recreate a market's boundaries. Companies that keep operating on the old template of the market may fail to see the impact of innovations. New entrants can often uncontested infringe upon an existing industry because they redefine it.

It is useful to think about structural market characteristics and firm positions as important determinants of competitive behavior. But it should be clear that they represent a transient picture. Especially in the context of innovation this becomes important. For example, based on the existing picture of the market, incumbents in the retail brokerage industry could evaluate their market share and positioning as it relates to traditional bricks-and-mortar retail brokerage. Confronted with the emergence of online brokerage, incumbents faced confusion and disagreement about whether this should be perceived as part of the existing market or as a completely different field. New entrants benefited from the lack of activity of incumbents to develop a solid position within the online brokerage market and used this as a platform to infringe upon the more traditional retail brokerage and financial services markets.

This adds to the discussion about the influence of knowledge structures on the competitive behavior of firms. For example, companies often engage in competitive behavior from a desire to defend their market share (Armstrong and Collopy, 1996). However, the market share optimization equation and the resulting competitive behavior changes completely if the market is defined within the confines of the existing incumbent business, or if new areas that result from technological innovation are included.
3.3. Game theory

In game-theoretic models, the focus shifts from competition as an industry-level characteristic to competition as a phenomenon that manifests itself in the rivalry between individual firms. This is expressed in formal game structures that contain decision alternatives and outcomes in different situations. None of the papers presented in this dissertation takes a game-theoretic approach in its research method (for a discussion of the drawbacks of game theory, see Chapter 1, Section 1.3). Nevertheless, the results do have some interesting implications that relate to the game theory literature.

Game theory is based on the strategic conflict between individual firms. The decision alternatives that companies face are formulated with respect to the actions of interdependent firms. This conforms to an oligopolistic view in that companies are affected by the actions of individual firms and that competition should be viewed in terms of this strategic conflict. In other words, competition is not characterized as an overall industry characteristic, but is identified in terms of individual firms. The results of chapter 4 show proof of the fact that companies react to individual competitors' moves, as opposed to competition in general. The results suggest the existence of a "cognitive oligopoly". This means that even in industries that cannot be characterized as an oligopoly, companies still construct it by focusing attention on a limited number of competitors.

The empirical results presented in this dissertation provide a useful addition to analytical models of competitive behavior. The normative implications that result from game theoretic models are based on the assumption that actors act rationally. But if we take into account the limited attention span of decision-makers and the influence that existing knowledge structures about the industry may have on their reasoning, it is highly doubtful that rational actors exist. We therefore need insight in the cognitive schemes that influence decision-makers so that they can be built into mathematical models. This would allow decision-makers to make correct inferences about the behavior of their competitors in different situations and assist them to optimize their behavior accordingly. Accurate conjectures about competitors' reactions hinge on the knowledge of the fundamentals that drive competitors' decisions. This requires knowledge about the beliefs that competitors hold about the firm's behavior.

3.4. Resource-based Competition

The results of this dissertation are in line with the fundamental principles of resource-based competition. Chapter 3 demonstrates that companies' response to competitive new product introductions is influenced by the resources they have available to respond. Competitive reaction is not only determined by the threat coming from a competitive action, but also by the firms' capability to respond.
The model developed in chapter 3 also emphasizes the critical role of how decision makers interpret information. The marketing literature asserts that market orientation is a critical capability (Day, 1994). Being able to gather, disseminate and respond to external information constitutes an important competence that assists the company to adapt to changing markets. The market orientation literature mainly looks at market sensing and the resulting inter-organizational information dissemination as an organizational process (Kohli and Jaworski, 1990; Slater and Narver, 1995). The emphasis is on defining activities that stimulate the acquisition and distribution of information about trends, events and changes on the market environment. This view agrees with the fact that market orientation, as it is an organizational capability, is defined by the activities that constitute it. However, it detracts attention from the content of the market sensing process and the interpretation of the assembled information. In Chapter 3, I show that it is this interpretation of information that plays a central role in determining the companies' response.

The findings in Chapter 4 also agree with the existing literature on the influence of incumbents' capabilities and resources on their response to innovation. Obviously, the necessary technological skills need to be present to keep up with technological progress. But the market performance of companies also depends on the presence of other capabilities (e.g. access to distribution channels, service networks, customer knowledge, manufacturing capabilities, etc.). The extent to which incumbents possess these complementary assets determines their performance in the advent of technological change (Teece, 1986; Tripsas, 1997). On the other hand, technological progress also makes existing assets obsolete. I show that this retards the entry of incumbents in new areas. For example, retail brokerages built customer relationships and brand awareness through their physical presence in retail locations. The internet replaces these bricks-and-mortar customer contact points. My results demonstrate that incumbents that rely to a great extent on retail locations are more reluctant to enter online brokerage. Similarly, I also provide evidence for the fact that incumbents that have built a capability around personalized customer relationships entered online brokerage later. These results illustrate that existing capabilities can become rigidities that hamper companies' flexibility in dealing with technological innovation (Leonard-Barton, 1992).

3.5. Behavioral theory of the firm

This dissertation integrates fundamental concepts of behavioral theories of competitive firm behavior. I distinguished two major research streams that are relevant to the research issues addressed in this dissertation. First, research within the scanning-interpretation-action paradigm focuses on how an organization searches for information in the environment and how this information is assessed. Second,
research on knowledge structures looks at how cognitive representations of the environment influences these processes.

Chapter 3 directly fits within the scanning-interpretation-action paradigm. This describes organizational actions as the result of receiving information from the environment and interpreting this information. In chapter 3, I focus attention on the interpretation-step, applied to a competitor's new product introduction. Distinguishing the different components of new product assessment enables one to get a better insight in the roots of competitive reaction to competitive new product introductions.

Chapter 4 starts from the premise that the entrance of other companies in a new industry area changes a company's assessment of this new market. The existing literature on mental models of competition form the basis to differentiate between the effect that different entrants have. I demonstrate that there exists a contagion effect in the response of established firms to technological innovation. In particular, companies enter new areas when similar companies do. This supports the suggestion from competitive cognition literature that companies within the same cognitive group are most influential on a company's behavior. It also suggests that by imitating each others' actions, existing mental representations of the competitive landscape are reinforced.

It has been suggested that competitive inertia in the face of technological discontinuities is due to the rigidity of decision-makers' views on the industry. This renders them insensitive to information that does not conform to these views. In my investigation of the online brokerage industry, I show that the entry of similar companies constitutes a strong signal that does resonate within the company.

3.6. Population ecology

A central theme in population ecology theory as applied to organizations is the idea that organizations follow the footsteps of others and model themselves likewise. Especially in contexts of high uncertainty, as is the case at the initial stages of an innovation's market development, firms imitate the behavior adopted by others (Haunschild and Miner, 1997). The mere that several other firms took the same action induces its legitimacy. This legitimation effect is prevalent in density-dependence models for organizational entry (Hannan et al., 1995; Hannan, 1997; Ranger-Moore et al., 1991). The basis of these models is the idea that increased population density initially increases a population's legitimation and therefore has a positive effect on the entry rate.

The concept of contagion as it is developed in chapter 4 is in line with this legitimation effect. It confirms that companies tend to see the actions of other firms as a signal of the validity of the action. In contrast to population ecology models, which are aggregate models of population evolution, I specify an individual-
level model. This enables the specification of contagion effects that are company-specific. In particular, I demonstrate that companies are mostly influenced by companies that are similar to themselves. This suggests that the legitimation effect is not homogeneous but that its effect possesses a distribution that depends on the identity of the company that enters a population.

3.7. Integration of findings: towards an integrative framework of competitive stress and inertia

This dissertation suggests that an integration of two perspectives is necessary in order to come to a more complete picture of the determinants of competitive response. The different theoretical foundations discussed above can be characterized as having an external, respectively internal perspective. The industrial organization and game theoretic views emphasize the threat that emanates from a competitive new product introduction. The underlying understanding is that companies respond to defend their market position against the market impact and threat represented in a competitive innovation. Thus, the response is expected to result from the external competitive pressure. The behavioral and resource-view have a more internal perspective. By focusing on the embeddedness of cognitive models and resource endowments they suggest that companies experience inertia in responding to innovation.

The general theme that runs through the three studies presented in this dissertation is that competitive reaction is the result of the balance between the competitive stress effectuated by the new product and competitive inertia that characterizes a company and slows down eventual reaction. The results of chapter 3 and 4 demonstrate the effect of cognitive factors as a source of inertia.

In chapter 3, I explicitly outline the competitive stress and inertia framework and incorporate both in an empirical model for competitive reaction. Although I do not explicitly use the same terminology in chapter 4, the same stress- and inertia-based arguments are used to support the contagion hypothesis. It is argued that the entry of similar competitors increases the pressure on a company to follow suit. At the same time, I argue that the entry of similar competitors evokes a shift in the perception of a new market because of the attention and relevance attached to the actions of similar competitors. This implies that the inertia due to a myopic view on the industry is diminished. In short: the hypothesized contagion effect is again due to the combined effects of competitive stress and inertia.

4. FUTURE RESEARCH AGENDA

In this section, I formulate a number of ideas for future research that build on the papers presented in this dissertation. Beyond the obvious and direct extensions of the models which I discussed in each paper and in the previous sections of this chapter, the results raise interesting issues that lack attention in the existing literature. The remainder of this chapter develops research ideas within three areas. The
discussion ranges in detail from the identification of underdeveloped areas and new themes to the formulation of concrete approaches to tackle specific research questions. First, I present research questions that formally extend the descriptive results of this dissertation to prescriptive recommendations. The second section deals with remaining questions on the issue of incumbent inertia. Third, I expand on a number of topics that relate to longitudinal competitive behavior and the resulting market evolution.

4.1. Performance Implications

4.1.1. Entry timing and incumbent performance

The long-run profitability of a firm is linked to its ability to produce a steady stream of innovations that provide an answer to competitive and environmental pressures. In chapter 4, I looked at the timing of entry of incumbents in new technology-created niches in their industry. The results explain when an incumbent enters, but do not imply performance implications related to that timing of entry. This is an issue for further research. Thinking about this question, it is important to realize that the issue at stake for incumbents involves both the existing and new market. Incumbents seek to optimize performance over the two areas. Performance models that only explain success in the new market do not address this. The long-term overall performance implications of the entry time of the incumbent company could be studied through an event study.

Event study methodology uses the stock price of a company as a measure of the long-term performance implications of a company action (Chaney et al., 1991). The advantage of stock-price changes over other performance measures are multiple: (1) they have a forward-looking, long-term focus, (2) they are adjusted for the risk associated with the action, (3) due to the temporal adjustments, there is a specific link to an event and (4) they incorporate the strategic value of actions.

In an efficient market, stock prices reflect all available information about the firm and any new information is instantaneously incorporated in the stock price. Therefore, a change in stock price is a reflection of changes in the expected future cash flow of firms. Because of that, the stock price change of a firm at the time when new information is announced represents the underlying change in the firm's future market performance. A necessary condition to apply the event study methodology is that an undisputable event date can be defined. This is the case for the entry of retail brokers in online brokers, for which either the public announcement or the actual entry can be defined. Also, the effect of the event has to be significant enough to change the firm's market value and to overcome regular noise in stock prove fluctuations. Because of the strategic significance of a retail brokers' entry in online brokerage, I expect this to be the case.

The event-study method can be used to answer a number of questions concerning the performance effect of the entry of incumbents in new industry areas. First and foremost, is there a significant expected
performance implication? Is this dependent on the timing of entry? Does the entry of incumbents negatively affects the performance expectation of other incumbents? And of new entrants?

4.1.2. Entry strategy under different conditions of cannibalization

If an incumbent wants to defend its current market, it can be reluctant to develop new technologies. The objective of not entering can be to delay development of a new niche. The motivation behind this is to avoid cannibalizing existing sales. The gravity of this issue depends on the extent to which the new area infringes upon the existing market. If it only makes the total market grow, the fear of cannibalization does not factor in the decision. In this situation, incumbents may benefit from early entry. Confirmation of this assertion needs research on the optimal entry time under different conditions of cannibalization. Besides the entry timing issue, a company's marketing behavior can also influence the extent to which the existing and new market impact each other. For example, the price level in each market affects the extent to which customers switch. These questions need a normative investigation that captures the most essential factors such as competition, cannibalization and order of entry effects as determinants of a firm's optimal entry strategy.

4.1.3. Time-competition and entry behavior

I showed that companies' actions are influenced by their competitors' behavior. Innovation by other companies creates pressure on the company to respond. In particular, I demonstrated that companies are inclined to enter a new market when their competitors do. However, this does not prove that this enhances their subsequent performance in the new market. It also raises the question whether not only the entry timing, but also the applied entry strategy is affected by the competitive pressure from others' entry. It has been shown that decision-makers are prepared to damage their own bottom-line if they can hurt competitors that way (Armstrong and Collopy, 1996). Similarly, we can hypothesize that companies are willing to compromise the quality of their market entry under pressure from competitors. For example, companies may be inclined to enter the market with an under-performing product because they do not want to lag behind their close competitors. To investigate this, we can formulate an entry-strategy mediated performance model. In this model, performance is assumed to be determined by the entry strategy of the company. This entry strategy is assumed to be driven by the pressure executed by competitors.

4.2. Incumbent Inertia

This dissertation adds to the discussion about resources and capabilities as a source of inertia. The "stickiness" of resource endowments implies that existing competencies direct the future avenues of the
company (Teece et al., 1997). But this can mean that companies get trapped within their current resource base i.e. core competences can become core rigidities (Leonard-Barton, 1992). The technological innovation literature has so far mainly focused on the restraining effect of technological capabilities (Tushman and Anderson, 1986). We need more insight in the influence of existing capabilities and resources on a firm’s adaptability. The state-of-the art knowledge remains ambiguous about its effect. Scholars have argued that incumbents fall prey to inertia in responding to technological innovation (Christensen and Bower, 1996; Tripsas, 1997). Others argue that their experience actually advantages them to exploit new opportunities (King and Tucci, 2002). These previous results prompt a number of new questions. What determines whether a competence will hamper innovation? Are there certain characteristics that distinguish them? Can we develop a typology of capabilities to explain the impact they have on a firm’s ability to deal with technology-created new market niches? Current literature suggests the distinction between dynamic capabilities and static capabilities plays a role (Teece et al., 1997). More research is needed to establish the relationship between certain capabilities and the timing of entry and performance of incumbents in new areas.

Also, we need more insight in the different contexts in which current capabilities hamper or encourage innovation. Because the existing studies mainly look at single industries, we know little about the effect of different types of innovations and market conditions. To realize that, cross-industry research is needed. For example, some innovations only require the development of a new technology but do not fundamentally disrupt the market process. Other innovations disrupt existing beliefs about critical success factors in the industry. This implies that cognitive mental models need to be changed. At the moment, we lack insight into whether this would have a different implication for incumbent inertia. Incumbent inertia has been attributed to existing capabilities because these are embedded within organizational routines and structures and therefore difficult to change. Incumbent inertia has also been attributed to the rigidity of mental models. The former reduces the company’s ability to change, the latter reduces its willingness to change. Whether the inflexibility of capabilities or cognitive factors contributes to incumbent inertia remains unresolved. Research that looks at innovations that differ in their impact on capability endowments and cognitive models could shed light on this debate.

4.3. Market Evolution

4.3.1. Path Dependency

On the one hand, companies favor from directing the company’s pursuits towards areas that fit its current resources and capabilities. On the other hand, managerial beliefs may play a central role in constraining organizational behavior by restricting and directing the options that are considered (Tripsas and Gavetti, 2000). The way companies respond to competitive challenges is thus already embedded
within their current state. This creates a path dependency in the company’s evolution that could be attributed to the capabilities of the company or to the impact of cognitive factors.

This idea that ‘history matters’ in a company’s evolution has not been explored in empirical research on how competitors respond to each others’ moves. One would assume that it has at least two consequences. First, it creates heterogeneity between companies. Second, it limits a company in the range of options it has available to respond to competitive challenges.

4.3.2. Competitor Imitation and Differentiation

This dissertation empirically demonstrated that incumbents respond to technological innovations when their similar counterparts do the same thing. In other words, equal companies imitate each others’ actions, thereby restoring their equality. Through this process, the imbalance between companies is corrected and existing strategic groups remain established. The strategic convergence that occurs between similar companies may be harmful in the long run. It is a low-risk strategy to imitate peers and conform to industry norms. But this reinforcement of existing competitive relationships impedes differentiation. This means that companies remain trapped within existing competition. The similarity in target markets and the competition for the same resources limits performance. Lack of variety between competitors leads to more head-to-head competition (Miles et al., 1993)

Thus, firms in established industries meet conflicting pressures to imitate and to differentiate. They face a continuous balancing act between conforming to industry norms and being different enough to escape competition. Optimal performance reportedly occurs at an intermediate level of similarity and differentiation (Deephouse, 1999). But this finding has not yet been replicated in unstable environments. Discontinuity creates the opportunity to reshuffle the cards. The high uncertainty associated with new areas may promote the tendency to follow the pack. But it also presents the chance to enlarge strategic differences and limit competition. This raises questions about the signals firms can employ to stimulate strategic divergence instead of convergence.

4.3.3. Entry and Market Development

Structural characteristics of the market influence competitive interactions. At the same time, the behavior of competitors will influence the market evolution. The interrelationship between competitive dynamics and the evolution of a market remains largely unexplored (Gatignon and Soberman, 2001). In particular, there is a need to study the factors that determine how markets initiated by technological discontinuities start off and develop. Many research topics are suggested by the need to improve understanding of the implications of market entry on the market development.
Entrant identification

A recent article quotes that: "In light of the importance of entry in models of industrial competition, it is surprising how little industry economists and strategists know about where entrants come from and how their backgrounds affect their fates" (Klepper and Simons, 2000).

Market entry plays a key role in economic models of industry evolution (Cabral, 1993; Eaton and Ware, 1987; Geroski, 1995; Klepper and Graddy, 1990; Klepper and Miller, 1993). But these studies fit within an industrial organization economics perspective, and therefore fail to recognize the heterogeneity between entrants. From a resource-based perspective, this constitutes a major deficiency. Companies search to optimally exploit their capabilities. The potential entrant pool therefore would expected to be determined by the set of companies that have developed the necessary critical capabilities. The suggests the question how companies' prior experience affects their entry time and subsequent strategy and performance.

Evolution of number of entrants

There is a lack of empirical research that studies the evolution of a market in terms of the number of competitors. There exists a vast amount of research on demand-side diffusion models. However, the mirrored supply-side has been largely ignored (Lambkin and Day, 1989). Several issues demand research attention. Can we formulate a empirically general model of entry in new markets? What are the dynamics to be included? How is this connected with the customer diffusion process? Is the model extendable to both new entrants and incumbents?

Simultaneous diffusion of demand and supply

The recursive relationship between market growth and entry of new companies remains unspecified. The profitability of a new market depends on the competition between companies. On the other hand, this competition may create a more attractive proposition for customers, leading to an enhanced product acceptance and diffusion. This suggests that increased competitive presence may actually increase the market's attractiveness because it stimulates demand. This increased demand in turn enhances new entry of new competitors. Clearly, the growth of the market is a simultaneous dynamic process, integrating diffusion of demand and supply.

Endogenous market evolution

Managers are increasingly interested in how their actions contribute to the development and evolution of a market. Diffusion theory is quite incomplete unless it recognizes the proactive nature of these actions (Robertson and Gatignon, 1986). But the current research lacks answers to questions about the impact of companies' actions on the market evolution. Given the different capabilities of new entrants and incumbents, it would be particularly interesting to investigate how the entry and actions of these have a
different impact on the market development. For example, does the early entry of incumbents accelerate takeoff of new technologies?

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In this section, a summary of the empirical results from extant studies on competitive reaction to new products is presented. I limit this discussion to the results concerning reaction to a competitive new product introduction, and leave out studies that consider action-reaction in general without defining the type of action. The discussion is structured according to the antecedents to competitive reaction that were considered. An overview of the context in which each study was conducted is given in Appendix 1.2. A detailed scheme of all the relationships that were empirically examined is provided in Appendix 1.3. Clearly, previous studies on competitive reaction to new products do not exhibit a uniform approach as to which aspect of reaction to study. Naturally, the first question to address is whether a competitor reacts or not. Robertson et al. (1995) investigate reaction to a new product announcement, whereas Waarts and Wierenga (2000) look at reaction to a new product introduction. The speed at which a competitor reacts is an important factor to enhance the effectiveness of reaction (Gatignon et al., 1997; Ferrier et al, 1999). A number of researchers therefore look at the determinants of reaction time (MacMillan et al, 1985; Bowman and Gatignon, 1995; Waarts, 1996; Kuester et al, 1999). Other investigated reaction characteristics include the reaction strength (Heil and Walters, 1993; Shankar, 1999; Kuester, 1999), reaction direction (Robinson, 1988) and the marketing mix element used for reaction (Kuester, 1999). Gatignon et al. (1997) specifically investigated the perceived success of reaction.
1. NEW PRODUCT INTRODUCTION CHARACTERISTICS

1.1. Product positioning

Several variables related to the positioning of the new product were investigated. The positioning of a new product can be considered in two ways. First, the relative positioning vis-à-vis competitors can be investigated. Second, the product positioning can be described according to the choice between a differentiation strategy and a low cost strategy. An important variable here is the product advantage of the new product, since this reflects superior positioning (Hauser and Shugan, 1983; Shankar, 1999).

Waarts (1996, 2000) found a significant positive impact on competitive reaction for products that are positioned close to the competitor’s products. This effect proceeds through a mediating effect from the competitive impact of such a product on the competitor’s market position.

About the generic positioning strategy of the new product entry, only preliminary conclusions can be drawn. While Shankar (1999) found incumbents to react strongly to new products that possess high quality, Robinson (1988) did not found a significant impact of the relative product advantage of a new entry. Reaction to products with a price advantage over other products was found to be less successful (Gatignon et al., 1997).

1.2. Marketing spending

The early studies on quantitative modeling of competitive reactions focus on marketing spending by estimating reaction elasticities (Hanssens, 1980; Gatignon et al., 1989). This approach leans on the idea that reaction is related to the marketing spending of the entrant. Explanatory studies on new product reaction do not confirm the attained importance of marketing spending. The effect on the occurrence of reaction was found to be insignificant (Waarts, 1996). On the other hand, Shankar (1999) found that incumbents accommodate a new product if it is launched with high marketing expenditures.

1.3. Scale of entry

Under scale of entry, I include those variables that describe the market share of the new product, its potential and the threat it represents. Each of these variables is often included as a sign of the market effect the new product introduction causes. The empirical results of this on competitive reaction towards the new product provide ambiguous conclusions. Reaction to new products that seem to have a high potential and are highly threatening is more likely and faster (MacMillan et al., 1985; Kuester et al., 1999;
Waarts and Wierenga (2000). However, Robinson (1988) found an inverted U-function between scale of entry and reaction. Apparently, competitors do not react to products that are highly successful on the market (Shankar, 1999), or to products that don’t show any positive market perspective.

1.4. Level of innovation

According to Waarts and Wierenga (2000) the effect of innovative products depends on the rivalry in the market. Innovative products will particularly threaten competitors if the rivalry between competitors is high. However, a high level of threat does not necessarily implies that reaction will occur. Empirical results concerning reaction towards highly innovative products suggest that firms experience a greater difficulty of responding. Competitors will more likely respond (specifically on the product dimension), but reaction will be slower and less successful (MacMillan et al., 1985; Robinson, 1988; Kuester et al., 2000; Gatignon et al., 1997).

2. ENTRANT CHARACTERISTICS

2.1. Market position

Waarts and Wierenga (2000) did not found a significant difference in reaction proneness against newcomers or incumbents. However, the actual number of reactions against start-up businesses has been found to be very low (Robinson, 1988).

Shankar (1999) includes the entrant’s marketing experience as a determining factor for reaction, based on the premise that it may be difficult to hurt an entrant with prior market experience by also spending more. This hypothesis was confirmed. Competitors react less strongly to entrants with a significant marketing experience. Bowman and Gatignon (1995) confirms that reaction speed is negatively related to the market share of the innovating company. Thus, it seems that companies are more hesitant to react to market leaders. If the incumbent and the entrant are subject to multimarket contact, incumbents are also less likely to retaliate (Shankar, 1999).

2.2. Reputation

Competitors will be more inclined to react to companies that have a reputation to be aggressive competitors (Waarts and Wierenga, 2000). Also, the impact of a competitor with a reputation for success is expected to be higher (Waarts, 1996)
3. CONTEXT CHARACTERISTICS

3.1. Technological uncertainty

Three separate studies each examine a different impact of the rate of technological change on reaction. A negative relationship between reaction time and the rate of technological change was found (Bowman and Gatignon, 1995). The success of reaction is however perceived to be low in technology intensive markets. Finally, Heil and Walters (1993) did not find a relationship between the frequency of new product launches in the market and the strength of reaction.

3.2. Market attractiveness

Overall, it can be concluded that incumbents react aggressively if the market is interesting, either through its size or through its growth (Robinson, 1988; Kuester et al, 1999; Shankar, 1999). Reaction will also be faster in high growth markets (Bowman and Gatignon, 1995; Kuester et al, 1999).

3.3. Market concentration

Different results were found concerning the influence of market concentration on reaction behavior. Overall, these point towards a conclusion that competitors are less likely to react in concentrated markets (Robinson, 1988; Kuester, 1999). The effect on reaction speed is either negative (Kuester et al., 1999) or not significant (Bowman and Gatignon, 1995).

4. REACTANT CHARACTERISTICS

4.1. Market share

Previous research reports mixed findings concerning the influence of the market share of the reacting company on reaction. Heil and Walters (1993), for example, report a non-significant relationship between market share and reaction strength. Other researchers found that market leaders react less strong, specifically on the product dimension (Kuester et al, 1999). Shankar (1999) claims that this can be explained by the fact that market leaders do not feel threatened by a new competitive product. A nondominant company is more threatened by a new entry, and will therefore react stronger (Shankar, 1999). There is also conflicting evidence concerning the effect of market share on reaction timing. Some scholars found that market leaders react faster (Bowman and Gatignon, 1995), whereas others found they react slower (Kuester et al, 1999).

4.2. Marketing instrument elasticity
Competitors will respond to new entries by using their most effective weapon (Gatignon et al., 1989). This means that the instrument with the highest elasticity will be utilized. Shankar (1999) confirms this finding by showing that a high advertising or sales force elasticity increase reaction strength. These results suggest that competitors infer their feasibility to respond to a new entry and take this into account when making the decision about if and how to respond.

REFERENCES

Appendix 1.2

Overview of explanatory studies on competitive reaction
<table>
<thead>
<tr>
<th>N = 186</th>
<th>Rating firm</th>
<th>Preference</th>
<th>Demand</th>
<th>Product &amp; price</th>
<th>Industry characteristics</th>
<th>Growth opportunities</th>
</tr>
</thead>
<tbody>
<tr>
<td>N = 69 (reaction: N = 34)</td>
<td>Rating firm</td>
<td>Type of Industries</td>
<td>Preference</td>
<td>No information</td>
<td>New product announcement</td>
<td>No specialized</td>
</tr>
<tr>
<td>N = 101</td>
<td>Rating firm</td>
<td>NP awareness</td>
<td>Type of Industries</td>
<td>No specialized</td>
<td>No specialized</td>
<td>No specialized</td>
</tr>
<tr>
<td>N = 196</td>
<td>Rating firm</td>
<td>Time</td>
<td>Type of Industries</td>
<td>No specialized</td>
<td>No specialized</td>
<td>No specialized</td>
</tr>
<tr>
<td>N = 15</td>
<td>Rating firm</td>
<td>Reaction reported by</td>
<td>Type of reaction</td>
<td>No specialized</td>
<td>No specialized</td>
<td>No specialized</td>
</tr>
</tbody>
</table>

**Competitive Reaction to a New Product**

- Initial reactions to new product announcements.
- Comparison of new product announcements vs. no new product announcements.
- Comparison of specialized vs. no specialized reactions.
- Comparison of different types of industries with respect to new product announcements.

**Key Research Questions**

1. How do firms react to new product announcements?
2. Do specialized firms react differently to new product announcements compared to non-specialized firms?
3. Do certain types of industries react differently to new product announcements compared to others?
<table>
<thead>
<tr>
<th>Author (year)</th>
<th>Key research question</th>
<th>Type of action</th>
<th>Context</th>
<th>Reaction</th>
<th>Data</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shankar (1999)</td>
<td>Entrant characteristics + incumbent characteristics + market/industry environment characteristics → incumbent response (marketing spending)</td>
<td>Scale of entry Marketing spending</td>
<td>US prescription drug industry</td>
<td>Relative marketing spending (sales and advertising)</td>
<td>Industry records with entrant and respondent marketing data</td>
</tr>
<tr>
<td>Waarts and Wierenga (2000)</td>
<td>Action and actor characteristics → perceived threat → reaction</td>
<td>Level of innovation Intended brand position</td>
<td>FMCG</td>
<td>Reaction (yes/no)</td>
<td>Mail survey with reacting firm</td>
</tr>
</tbody>
</table>

**Competitive reaction to a competitive action**

<table>
<thead>
<tr>
<th>Author (year)</th>
<th>Key research question</th>
<th>Type of action</th>
<th>Context</th>
<th>Reaction</th>
<th>Data</th>
</tr>
</thead>
<tbody>
<tr>
<td>Haxsoms (1980)</td>
<td>Actor marketing spending → reactor marketing spending</td>
<td>No specification</td>
<td>US domestic air travel</td>
<td>Spending</td>
<td>Industry records of market behavior</td>
</tr>
<tr>
<td>Smith et al. (1989)</td>
<td>environmental factors + organisational factors → response time</td>
<td>no specification</td>
<td>Electronics</td>
<td>Time</td>
<td>Survey at reacting firm</td>
</tr>
<tr>
<td>Smith et al. (1991)</td>
<td>type of action + reactor characteristics → response → performance</td>
<td>no specification</td>
<td>Airline industry</td>
<td>Reaction likelihood Reaction lag Reaction order Imitation</td>
<td>Content analysis of actions and reactions reported in Aviation Daily</td>
</tr>
<tr>
<td>Chen et al. (1992)</td>
<td>action → response lag + number of responses</td>
<td>no specification</td>
<td>Airline industry</td>
<td>Number of reactions Response lag</td>
<td>Content analysis of actions and reactions reported in Aviation Daily</td>
</tr>
<tr>
<td>Leeflang and Wittink (1992)</td>
<td>Changes in price or promotion levels → reaction by change in price or promotion levels</td>
<td>Changes in price or promotion levels</td>
<td>FMCG</td>
<td>Reaction by change in price or promotion levels</td>
<td>Weekly scanner data</td>
</tr>
<tr>
<td>Ramaswamy et al. (1994)</td>
<td>Market characteristics &amp; business unit positions → retaliatory or cooperative behavior</td>
<td>salesforce in- or decrease and price in- or decrease</td>
<td>Industries only industrial markets</td>
<td>Retaliatory or cooperative behavior</td>
<td>PIMS Database, reaction reported by actor</td>
</tr>
</tbody>
</table>
APPENDIX 1.3

Overview of empirical results on competitive reaction to new product introductions
<table>
<thead>
<tr>
<th>Stakeholder (1999)</th>
<th>Description</th>
</tr>
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<tbody>
<tr>
<td>Shares Involved</td>
<td>Must be high</td>
</tr>
<tr>
<td>Aggressiveness</td>
<td>Should be high</td>
</tr>
<tr>
<td>Success Potential</td>
<td>Should be high</td>
</tr>
<tr>
<td>Transactional Value</td>
<td>Should be high</td>
</tr>
<tr>
<td>Market Share</td>
<td>Must be high</td>
</tr>
<tr>
<td>Develop. Time</td>
<td>Must be short</td>
</tr>
<tr>
<td>Capabilities</td>
<td>Must be strong</td>
</tr>
</tbody>
</table>

### Innovation Characteristics

<table>
<thead>
<tr>
<th>Description</th>
<th>Recipe Potential</th>
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<tbody>
<tr>
<td>Received Ideal</td>
<td>Expected Impact</td>
</tr>
<tr>
<td>Level of Innovation</td>
<td>Realized Price Advantage</td>
</tr>
<tr>
<td>Market Share</td>
<td>Received Price Advantage</td>
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</table>

### Reaction Strength

<table>
<thead>
<tr>
<th>Description</th>
<th>Response Time</th>
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<tr>
<td>Reaction (Yes/No)</td>
<td>Must be short</td>
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### New Product Characteristics

<table>
<thead>
<tr>
<th>Description</th>
<th>Must be high</th>
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<tbody>
<tr>
<td>Visibility</td>
<td>Marketing Effort</td>
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<tr>
<td>Signal Confidence</td>
<td>Consequences</td>
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<tr>
<td>Signal Credibility</td>
<td>Success</td>
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<thead>
<tr>
<th>Description</th>
<th>Must be high</th>
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<tbody>
<tr>
<td><strong>Reactant Characteristics</strong></td>
<td>reaction (yes/no)</td>
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<tr>
<td>Capacity use reactant</td>
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<tr>
<td>Receiving firm's fixed commitments in product category</td>
<td>Robertson (1995) +</td>
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<tr>
<td>Incumbent advertising elasticity</td>
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<tr>
<td>Incumbent sales force elasticity</td>
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<tr>
<td><strong>Market Characteristics</strong></td>
<td></td>
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<tr>
<td>Exit costs</td>
<td></td>
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<tr>
<td>rate of technological change</td>
<td>Bowman (1995) -</td>
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<tr>
<td>Freq. NP launch</td>
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<tr>
<td>Multimarket contact</td>
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<tr>
<td>Incumbent's strategic importance of market</td>
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<td>Incumbent's relative marketing advantage</td>
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<td>Standardized products</td>
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<td>Reaction speed</td>
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<tr>
<td>Advertising/salesforce/channel reaction intensity</td>
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<td>Product reaction intensity</td>
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<td>price decrease reaction intensity</td>
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| Growth | Expected market size effect | Growth
| Warps (1996) n= |

| + Warps + market |
| + Warps (1996) |
| + + Warps (1996) |
| - Warps (1996) n= |

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<thead>
<tr>
<th>Innovator characteristics</th>
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<tr>
<td>Kuester (1996) n=500</td>
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<td>Robinson (1996) n=500</td>
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| + Warps (1996) |
| + Robinson (1996) |

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<th>New Product characteristics</th>
<th>Expected competitive impact</th>
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<tr>
<td>Intensity of price retaliation</td>
<td>Reaction direction</td>
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<tr>
<td>Scale of entry (MA &amp; capacity)</td>
<td>intensity of price retaliation</td>
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<tr>
<td><strong>Reactant Characteristics</strong></td>
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<td>Market share reactant</td>
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<td>Capacity use reactant</td>
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<td>Receiving firm's fixed commitmements in product category</td>
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<td>Incumbent sales force elasticity</td>
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<td><strong>Market Characteristics</strong></td>
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<td>Exit costs</td>
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<td>Rate technological change</td>
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<td>Advertising/salesforce/channel reaction intensity</td>
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<td>Product reaction intensity</td>
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<td>Price decrease reaction intensity</td>
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<tr>
<td>Scale of company (MIL or capacity)</td>
<td>Expected market size effect</td>
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<td>Incremental marketing expenditure</td>
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<td>Shares involved</td>
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<td>Aggriffiness reputation</td>
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<td>Success reputation</td>
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<td>Luminousness/ new channel</td>
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<td>Market share innovation</td>
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<td>Development line</td>
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<td>Capability as innovator</td>
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<table>
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<tr>
<th>Innovation characteristics</th>
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<td>Level of innovation</td>
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<td>Real product advantage</td>
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<td>Strategic asset</td>
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<td>Relevance price advantage</td>
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<td>Initial brand position</td>
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<td>Organization mission</td>
</tr>
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<td>Complexity</td>
</tr>
<tr>
<td>Redactability</td>
</tr>
<tr>
<td>Signal credibility</td>
</tr>
<tr>
<td>Signal consequence</td>
</tr>
<tr>
<td>Signal hostility</td>
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<tr>
<td>Signal commonment</td>
</tr>
<tr>
<td>Marketing effort</td>
</tr>
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<td>Visibility</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Reaction breadth</th>
<th>Reaction success</th>
<th>Reaction other than product</th>
<th>New Product Characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reactant Characteristics</td>
<td>Reaction other than product</td>
<td>Reaction success</td>
<td>Reaction breadth</td>
</tr>
<tr>
<td>----------------------------------------------------------------------------------------</td>
<td>----------------------------</td>
<td>-----------------</td>
<td>-----------------</td>
</tr>
<tr>
<td>Market share react.</td>
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</tr>
<tr>
<td>Capacity use reactant</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Receiving firm's fixed commitments in product category</td>
<td></td>
<td>Robertson (1995) n.s.</td>
<td></td>
</tr>
<tr>
<td>Incumbent advertising elasticity</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Incumbent sales force elasticity</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Market Characteristics</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Exit costs</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Switching costs</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Market growth</td>
<td>Gatignon (1997) +</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Industry concentration</td>
<td></td>
<td>Kuester (1999) -</td>
<td></td>
</tr>
<tr>
<td>Rate technological change</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Technological intensity</td>
<td>Gatignon (1997) -</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Freq. NP launch</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Price sensitivity</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Multimarket contact</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Incumbent's strategic importance of market</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Incumbent's relative marketing advantage</td>
<td>Gatignon (1997) +</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Standardized products</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reaction speed</td>
<td>Gatignon (1997) +</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Advertising/salesforce/channel reaction intensity</td>
<td>Gatignon (1997) +</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Product reaction intensity</td>
<td>Gatignon (1997) +</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Price decrease reaction intensity</td>
<td>Gatignon (1997) n.s.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Breadth of response</td>
<td>Gatignon (1997) -</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
APPENDIX 2.1

Measurement Details

Data were abstracted from the IntroStrat Database\(^1\). This database is the result of a large scale survey to gather international data on new product launch and its market impact\(^2\). Details about the survey construction and data collection process are described in Chapter 2.

From the database, observations within industrial markets were selected. Relevant variables pertaining to the conceptual framework presented in Chapter 2 were selected. This appendix contains additional details about the measurement of these variables and about the construction of the measures used in the analysis. The measures are discussed in alphabetical order.

Competitive Reaction

Measured as:

*Please indicate if competition reacted by changing one or more of the marketing mix variables (multiple answers possible):*

☐ Change of price
☐ Change of product assortment
☐ Change of promotion

\(^1\) © EJ. Hultink, Delft University of Technology

\(^2\) Hultink, EJ. (1997), "Launch strategies and new product performance - An empirical international study" Delft, Delft University of Technology
☐ Change of distribution

Distribution effort

Measured as:

Indicate the amount of resources spent on distribution in the first year after the product launch in comparison to competitors (select one):

☐ More than competitors
☐ Not more or less than competitors
☐ Less than competitors

Market growth

Measured as:

Indicate the growth rate of the total market in which the new product was introduced (select one):

☐ Less than 0%
☐ Between 0-5%
☐ Between 6-10%
☐ More than 10%

Previous innovation success

Measured as:

Indicate the percentage of company’s sales coming from products introduced in the last five years (between 0 and 100%):

__________________

Product newness

The product newness measure is construed from two variables.

Measured as:
Indicate how innovative the new product is in comparison to competing products:

☐ The product is more innovative than competing products
☐ The product is equally innovative than competing products
☐ The product is less innovative than competing products

Indicate the number of companies that offered similar competing products at the time of introduction

☐ Not one company
☐ 1-3 companies
☐ More than 4 companies

Further analysis reveals that these two variables were not independent. In response to reviewers' concerns, radical new products were identified in two steps. First, new products were identified according to the relative innovativeness of the product (more innovative than competing products, equally innovative or less innovative products). The products that were more innovative then were further subdivided to distinguish those products for which no competing similar products were already on the market. These are labeled as 'radical new products'.

Promotion effort

Promotion effort could be captured by two variables: promotion expenditures and the number of communication channels used. Further analysis revealed that a significant relation exists between promotion expenditures and variety of communication channels. (One-way ANOVA; F(2,481) = 8.98; p<0.0001). I decided to use a two-item formative measure that captures both the breadth and depth of the promotion effort construct. This measure is the mean of the standardized original promotion variables.

Indicate the amount of resources spent on distribution in the first year after the product launch in comparison to competitors (select one):

☐ More than competitors
☐ Not more or less than competitors
☐ Less than competitors

Indicate the communication instruments that were used in the first year after the launch (multiple answers possible):

☐ Trade Promotion
☐ Consumer Promotion
☐ Salesforce Promotion
☐ Direct Marketing
☐ TV advertisement
Targeting strategy

Indicates the targeting strategy the company followed. The definition of targeting strategies originates from the PIMS-studies, which were among others used by Lambkin (1988, 1992). Pilot tests revealed that respondents had no problem with these categories. The definitions that were provided to respondents were:

- A niche strategy targets one specific customer segment with a product developed just for them.
- A selective strategy targets several distinct segments with the same product and different marketing mixes.
- An undifferentiated strategy targets the whole market with the same product and marketing mix.

Measured as:

*Indicate the targeting strategy used:*
- Niche strategy
- Selective strategy
- Undifferentiated strategy

References

APPENDIX 3.1

Measurement Model for Self-Reported Multiple Item Measures

1. PRELIMINARY SCALE CONSTRUCTION

Examination of face validity, item-total correlations and exploratory factor analysis provided preliminary scales that can further be tested. All items are measured on a 7-point Likert scale and described in Table 3 (Page A3.1-5).

<table>
<thead>
<tr>
<th>Construct</th>
<th>Number of items</th>
<th>Cronbach's alpha</th>
</tr>
</thead>
<tbody>
<tr>
<td>Propensity to react</td>
<td>2</td>
<td>0.846</td>
</tr>
<tr>
<td>Perceived centrality of attack</td>
<td>4</td>
<td>0.890</td>
</tr>
<tr>
<td>Perceived potential</td>
<td>3</td>
<td>0.728</td>
</tr>
<tr>
<td>Perceived feasibility</td>
<td>5</td>
<td>0.843</td>
</tr>
</tbody>
</table>

*Table 1: Exploratory scale construction*
2. SINGLE-LEVEL CONFIRMATORY FACTOR ANALYSIS

2.1. Single-level confirmatory factor analysis

To test the measurement model the total sample was split in two according to the two industries that were run. After deletion of cases with missing values, sample 1 retains 174 valid observations and sample 2 contains 136 observations. The confirmatory factor analysis was first tested on one sample. The stability of the model was examined by applying the resulting model to the second sample.

2.1.1. Test of normality assumption

The data were tested on the assumption of multivariate normality. The test showed no violation of this assumption, although some items showed a relatively high skewness or kurtosis value. However, maximum likelihood estimates are robust against moderate violations of the multivariate normality assumption if the sample size is greater than 100, which is the case (Steenkamp and Van Trijp, 1991).

2.1.2. Unidimensionality

Unidimensionality reflects the extent to which a single trait or construct underlies a set of measures. The use of item-total correlations has traditionally been employed to test for unidimensionality. However, confirmatory factor analysis provides a more rigorous assessment (Gerbing and Anderson, 1988). A confirmatory factor analysis was performed on all the items, using the constructs the exploratory factor analysis revealed. The \( \chi^2 \) statistic tends to be sensitive for large sample sizes, so I will focus primarily on the goodness-of-fit measures to assess model fit (Steenkamp and Van Trijp, 1991).

Primary assessment of the measurement model focuses on unidimensionality. The overall fit of the model provides enough information to determine whether unidimensionality is satisfied (Gerbing and Anderson, 1988; Steenkamp and Van Trijp, 1991). The overall fit of the model was poor but the pattern of standardized residuals provided a guide to improve the measurement model. Two items both have high standardized residuals with all other items, without showing a clear pattern. Both items were removed. This substantially improved the fit of the model. The parsimonious fit measure \( \chi^2/df \) is below the recommended threshold of 2.0 (1.87) and the root mean square error of approximation is below the recommended 0.08 level (0.068). Given the adequacy of the goodness of fit indices, no respecifications were made.

The goodness-of-fit measures are:

\[ \chi^2 (48) = 89.85; \ p < 0.001 \]

GFI = 0.92
CFI = 0.95
NFI = 0.90
NNFI = 0.93
IFI = 0.95
RMSEA = 0.068
RMR = 0.068

2.1.3. Convergent validity

Convergent validity is satisfied if all factor regression coefficients are statistically significant (provided that the overall fit of the model is satisfactory) and if the correlation between each item and its construct exceeds 0.5 (Steenkamp and Van Trijp, 1991). These conditions are satisfied.

2.1.4. Reliability

The composite reliability of the different constructs was calculated (Gerbing and Anderson, 1988). All of these exceed the minimum level of 0.6.

2.1.5. Discriminant validity

First, none of the 95% confidence intervals around the estimated correlation between latent constructs included 1. To test for discriminant validity, a series of nested confirmatory factor analyses was performed, in which the correlation between a set of two latent variables was set to 1. The subsequent increase in $\chi^2$ was significant in all cases. A more stringent test suggests that the amount of variance extracted for each construct should exceed the squared correlation between them (Fornell and Larcker, 1981). All constructs met this criterion.

2.1.6. Stability

The stability of the measurement model was tested by performing the same set of tests on the second sample. Although the fit of the model is less satisfactory than with the first sample, it is still sufficient.

The goodness-of-fit measures are:

$\chi^2 (48) = 91.34; p = 0.00016$
GFI = 0.91
CFI = 0.95
NFI = 0.91
NNFI= 0.94
IFI= 0.95
RMSEA= 0.071
RMR= 0.069

The parsimonious fit measure $\chi^2$/df is below the recommended threshold of 2.0 (1.90) and the root mean square error of approximation is below the recommended 0.08 level (0.071). All conditions for convergent validity, reliability and discriminant validity discussed above for the first sample are satisfied, except for the more stringent test on discriminant validity (Fornell and Larcker, 1981) which is only partially satisfied.

3. INTRA-CLASS CORRELATIONS

The intra-class correlations are an estimate of the proportion of the between-level variation over the total variation. Table 2 gives the item intra-class correlations.

<table>
<thead>
<tr>
<th>Act1</th>
<th>Act2</th>
<th>Targ1</th>
<th>Targ2</th>
<th>Targ3</th>
<th>Pot1</th>
<th>Pot2</th>
<th>Pot3</th>
<th>Fea1</th>
<th>Fea2</th>
<th>Fea3</th>
<th>Fea4</th>
</tr>
</thead>
<tbody>
<tr>
<td>.083</td>
<td>.040</td>
<td>.062</td>
<td>.053</td>
<td>.116</td>
<td>.097</td>
<td>.115</td>
<td>.030</td>
<td>.206</td>
<td>.297</td>
<td>.111</td>
<td>.170</td>
</tr>
</tbody>
</table>

Table2: Intra class correlations

4. MULTI-LEVEL CONFIRMATORY FACTOR ANALYSIS

The multi-level confirmatory factor analysis is estimated for the entire sample. The goodness-of-fit measures are:

$\chi^2$ (48) = 90.54; p= 0.0002
GFI= 0.95
CFI= 0.97
NFI= 0.95
NNFI= 0.93
IFI= 0.98
RMSEA= 0.076
RMR= 0.055

The parsimonious fit measure $\chi^2$/df is below the recommended threshold of 2.0 (1.89) and the root mean square error of approximation is below the recommended 0.08 level (0.076). All conditions for unidimensionality, convergent validity, reliability and discriminant validity are satisfied.
Table 3 provides an overview of the coefficient estimates for the multilevel confirmatory factor analysis.

<table>
<thead>
<tr>
<th></th>
<th>Within-individual Completely standardized coefficients</th>
</tr>
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<tbody>
<tr>
<td></td>
<td>Estimate</td>
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<tr>
<td><strong>Propensity to react</strong></td>
<td></td>
</tr>
<tr>
<td>Act 1</td>
<td></td>
</tr>
<tr>
<td>Our company should take action in response to the introduction of X</td>
<td>.84</td>
</tr>
<tr>
<td>Act 2</td>
<td></td>
</tr>
<tr>
<td>We must quickly do something against X</td>
<td>.87</td>
</tr>
<tr>
<td><strong>Perceived centrality of attack</strong></td>
<td></td>
</tr>
<tr>
<td>Tar 1</td>
<td></td>
</tr>
<tr>
<td>X focuses on for us important segments</td>
<td>.89</td>
</tr>
<tr>
<td>Tar 2</td>
<td></td>
</tr>
<tr>
<td>X is a direct attack to our market</td>
<td>.92</td>
</tr>
<tr>
<td>Tar 3</td>
<td></td>
</tr>
<tr>
<td>X can perfectly co-exist besides our products (reversed)</td>
<td>.73</td>
</tr>
<tr>
<td><strong>Perceived potential success</strong></td>
<td></td>
</tr>
<tr>
<td>Pot 1</td>
<td></td>
</tr>
<tr>
<td>X is very important to company Y</td>
<td>.68</td>
</tr>
<tr>
<td>Pot 2</td>
<td></td>
</tr>
<tr>
<td>X will be a success</td>
<td>.76</td>
</tr>
<tr>
<td>Pot 3</td>
<td></td>
</tr>
<tr>
<td>X has a real quick-start on the market</td>
<td>.72</td>
</tr>
<tr>
<td><strong>Perceived Feasibility</strong></td>
<td></td>
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<tr>
<td>Fea 1</td>
<td></td>
</tr>
<tr>
<td>We are strong enough to cope with X</td>
<td>.64</td>
</tr>
<tr>
<td>Fea 2</td>
<td></td>
</tr>
<tr>
<td>A countermove is immediately possible</td>
<td>.66</td>
</tr>
<tr>
<td>Fea 3</td>
<td></td>
</tr>
<tr>
<td>It is impossible to battle X (reversed)</td>
<td>.60</td>
</tr>
<tr>
<td>Fea 4</td>
<td></td>
</tr>
<tr>
<td>We do not have the necessary flexibility to react (reversed)</td>
<td>.75</td>
</tr>
</tbody>
</table>

Table 3: Measurement model results

REFERENCES

1. Fornell, C. and D.F. Larcker, (1981) "Evaluating structural equation models with unobservable variables and measurement error", *Journal of Marketing Research*, 18 (February), 39-50
1. MARKET CHARACTERISTICS

Market growth is measured as the change in market size in terms of online brokerage accounts.

2. SALIENCE OF INCUMBENT ENTRY

The salience of a company is measured in terms of its total capital. Capital position is the measure used by the Securities Industry Association to rank securities companies and thus reflects the significance of the company in terms of the total set of activities related to the securities industry (not only retail brokerage).

The salience of incumbent entry (SAL) is measured as the maximum capital position among the incumbents that have entered the online brokerage market.

3. SIMILARITY WITH ENTERED INCUMBENTS

3.1. Size similarity

The size similarity of an incumbent with the entered incumbents is based on the number of customer accounts the company has (which is a measure of the market share of the company).
\( \Delta_{ij} \) is the difference between the logarithm of the number of accounts of company i and j.
The elements of the size similarity matrix are:

\[
SSIZE_{ij} = 1 - \frac{\Delta_{ij}}{\text{Max}_{i,j} \Delta_{ij}}
\]

The size similarity of an incumbent with the entered incumbents (SIMSIZE) is defined as the maximum similarity with any of the incumbents that have already entered.

\[
SIMSIZE_i(t) = \text{Max}_{j \in n_i(t)}(SSIZE_{ij})
\]

\( n_i(t) \) is the number of incumbents that have already entered the online brokerage market at time \( t \).

3.2. Resource similarity

The resource similarity of an incumbent with entered incumbents is based on a composite measure that contains different elements of the resource endowment of each company. \( \Delta_{Rij} \) is a vector of the standardized differences of company i and company j on eight variables that profile the company and are independent measures. The distance between two companies on these variables is defined as an Euclidean distance:

\[
DISRES_{ij} = \Delta_{Rij}^2 \Delta_{Rij}
\]

To remove the influence of difference in scale, every variable is divided by its range. This reduces the distance between two observations on each variable to a 0-1 scale. Similarly, the distance between two observations on a categorical variable is 0 (different category) or 1 (same category).

The eight variables are:

1. STATES: number of states with physical presence (reflects regional presence of the company)
2. ACC: number of customer accounts (reflects existing customer relationships)
3. OFF: number of offices (reflects bricks and mortar-dependence)
4. RETTOT: retail to total ratio (reflects dependence on retail market)
5. ACCOFF: accounts per office (reflects scattered localized presence)
6. ACCREP: accounts per representative (reflects personalization of customer relationships)
7. DESC: activity description (reflects positioning within retail brokerage market)
8. BANK: bank affiliation (reflects complimentary banking relationship)
The elements of the resource similarity matrix are:

\[ SRESS_{ij} = 1 - \frac{DISRES_{ij}}{\max_{i,j} DISRES_{ij}} \]

The size similarity of an incumbent with the entered incumbents (SIMRESS) is defined as the maximum similarity with any of the incumbents that have already entered.

\[ SIMRESS_i(t) = \max_{j \in n_{i,t}} (SRESS_{ij}) \]

\( n_i(t) \) is the number of incumbents that have already entered the online brokerage market at time \( t \).

3.3. Market similarity

The market similarity between two companies is based on the US states in which the company has a physical presence (bricks-and-mortar office).

The market similarity \( SMKT_{ij} \) between company \( i \) and company \( j \) is calculated as the proportion of shared markets on the total number of markets in which either of the two companies \( i \) or \( j \) are present. The elements of the market similarity matrix are:

\[ SMKT_{ij} = \frac{\sum_m D_{im} D_{jm}}{\sum_m D_{im} + D_{jm} - D_{im} D_{jm}} \]

\( D_{im} \) is a dummy variable denoting whether company \( i \) is present in market \( m \).

SIMMARKT is the maximum similarity between the company and the set of entered incumbents at any point in time.

\[ SIMMARKT_i(t) = \max_{j \in n_{i,t}} (SMKT_{ij}) \]

4. COMPANY COVARIATES

- STATES: number of states with physical presence
- ACC: number of customer accounts (in million)
- OFFICES: number of offices
RETTOT: ratio of the number of retail brokerage representatives to the total number of brokerage representatives
ACCOFF: accounts per office (in million)
ACCREP: accounts per representative
DESC: activity description
BANK: bank affiliation

Relationship between covariates:

**Correlation Matrix**

<table>
<thead>
<tr>
<th></th>
<th>STATES</th>
<th>ACC</th>
<th>OFF</th>
<th>RETTOT</th>
<th>ACCOFF</th>
<th>ACCREP</th>
</tr>
</thead>
<tbody>
<tr>
<td>STATES</td>
<td>100</td>
<td>65.3</td>
<td>46.1</td>
<td>24.1</td>
<td>-15.7</td>
<td>-5.7</td>
</tr>
<tr>
<td>ACC</td>
<td>65.3</td>
<td>100</td>
<td>41.9</td>
<td>15.2</td>
<td>4.3</td>
<td>1.9</td>
</tr>
<tr>
<td>OFFICES</td>
<td>46.1</td>
<td>41.9</td>
<td>100</td>
<td>14.1</td>
<td>-10.1</td>
<td>-1.2</td>
</tr>
<tr>
<td>RETTOT</td>
<td>24.1</td>
<td>15.2</td>
<td>14.1</td>
<td>100</td>
<td>1.1</td>
<td>-39.8</td>
</tr>
<tr>
<td>ACCOFF</td>
<td>-15.7</td>
<td>4.3</td>
<td>-10.1</td>
<td>1.1</td>
<td>100</td>
<td>42.1</td>
</tr>
<tr>
<td>ACCREP</td>
<td>-5.7</td>
<td>1.9</td>
<td>-1.2</td>
<td>-39.8</td>
<td>42.1</td>
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</tr>
</tbody>
</table>

**ANOVA**

<table>
<thead>
<tr>
<th></th>
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</thead>
<tbody>
<tr>
<td></td>
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<tr>
<td>STATES</td>
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</tr>
<tr>
<td>ACC</td>
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</tr>
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<td>OFFICES</td>
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<tr>
<td>ACCOFF</td>
<td>0.45</td>
</tr>
<tr>
<td>ACCRT</td>
<td>0.66</td>
</tr>
</tbody>
</table>

A4.1-4
1. INDUSTRY SELECTION

The empirical results originate from an archival study of the online brokerage industry in the U.S. Although the theoretical reasoning within this chapter does not rely on certain industry characteristics, not every industry would be equally suitable to study empirically. Data-collection issues and statistical analysis issues have to be considered in selecting an empirical context in which the statistical model will be applied. Enough data-points and data variance are needed for the statistical analysis. Also, data-availability issues need to be considered in the selection of an industry.

The online brokerage market has a number of characteristics that make it appropriate to study through historical analysis. The research questions demand that I am able to identify the complete population of incumbent firms and that I can gather company information. The amount of structured information that is readily available on the retail brokerage industry makes this possible. Information about the development of the online brokerage industry is also possible to compile. This new market was the first e-commerce market to catch on and be successful. Both fast-growing new entrants and high-profile incumbents firms were involved. It has therefore spawned much interest and a large number of publications. The relatively short period of time in which the industry developed limits the time-period over which data have to be collected. In spite of this short time-period, the high speed of change in the industry induces enough variance within the data. The large number of entrants ensures that enough data-points are available for statistical analysis.
Online brokerage is a radical innovation because it pushed the envelope within the industry. It involved radically new technology and changed core concepts of the traditional brokerage offering. In the technological sense, it was competence-destroying for existing traditional retail brokerages. However, complimentary assets of retail brokers retained their value in the new online brokerage market (e.g. customer relationships, reputation, the existence of added services).

Online brokerage has become an important market. By the end of 2000, there were over 20 million online brokerage accounts in the US. These accounts amass $959 billion. 935000 trades were executed a day, good for almost one quarter of the total trades on the New York Stock Exchange and Nasdaq (Source: Salomon Smith Barney, February 22, 2001).

The brokerage industry is important, not just because of its own nature, but also because of its similarity to other industries. The online brokerage story is not a unique case. The same structure applies to other industries in which a relatively stable number of incumbents companies are disrupted by a radical innovation. This innovation forces the industry from relative calm into turbulent times. It potentially increases the total size of the pie in the market, but also blurs industry boundaries and creates the opening for new entrants to come in. The same situation applies to wireless communication providers, travel agencies, data-network suppliers, book retailers, etc.

2. SAMPLE SELECTION

The largest 70 US retail brokerage firms were selected, based on their number of retail brokerage customer accounts as well as the number of retail registered representatives (Source: Securities Industry Yearbook 1996).

In terms of the total securities industry as gathered in the Securities Industry Association (which also includes non-retail firms, that do not belong in the sample population), the sample of 70 companies represents:

81.5 % of retail brokerage representatives
76.6 % of employees
73.9 % of offices
63.9 % of capital

Because the total population on which these figures are based also includes firms that do not have retail brokerage activities, these figures are a bottom limit for what the sample represents in terms of the
population of retail brokers only. For the same reason, the sample represents least of this population in terms of capital position, offices and employees and most in terms of retail registered representatives.

Each of the identified cases was subsequently checked. A case was deleted if:
- The case is not active in retail brokerage
- The case does not handle stock trading, but carries only futures, commodities, funds or options
- The case is only regionally active (a threshold of 40 states was used)
- The case is specialized in direct access day-trading, primarily oriented at professionals
- The case is not active in the US

3. ENTRY DATE

For each of the cases, entry and possible exit dates were looked up. Reliable sources, external to the company itself, were preferred. To assure reliability, the dates were double-checked through different sources whenever possible. Every source was critically evaluated to assure validity. For example, launch announcements were not considered a trustworthy source of information.

The data collection process contained the following steps:
1. Entry dates were found in published articles from the following databases:
   - Lexis-Nexis
   - Dow Jones
   - ABI-Inform
2. If an entry date could not be found in published records, the company website was searched (particularly the press releases section)
3. If this provided no result, the company was contacted through e-mail and requested for the month and year they started offering internet brokerage for retail customers.

4. EXIT DATE

The same databases as above were examined for information on possible exits. Each case was also checked to make sure it was still active. Most exits occur through a take-over. If an online broker is acquired by another company, but remains to be operated as a separate unit under the existing name, it is not counted as an exit.

5. INCUMBENT CHARACTERISTICS

The following characteristics of the companies in the sample are gathered:
STATES: number of states with physical presence
   Source: company website, annual report or Lexis-Nexis database
ACC: number of customer accounts
   Source: Securities Industry Yearbook
OFFICES: number of offices
   Source: Securities Industry Yearbook
RETTOT: ratio of the number of retail brokerage representatives to the total number of brokerage representatives
   Source: Securities Industry Yearbook
ACCOFF: accounts per office
   Source: Securities Industry Yearbook
ACCREP: accounts per representative
   Source: Securities Industry Yearbook
DESC: activity description
   Source: Securities Industry Yearbook
BANK: bank affiliation
   Source: Hoover's database or company report

Missing values are completed from multiple sources including electronic databases such as Dow Jones, Hoover's and Lexis-Nexis, annual reports and company press releases (reliability is assured by corroborating different sources of evidence).

6. MARKET GROWTH

Market size is measured in terms of the total number of online brokerage accounts. The number of accounts only contains "online accounts", that is pure online accounts or accounts that have been opened with the internet as main transaction-medium, even if other communication channels with the broker are possible.

The data are based on third-party market reports collected from the databases TableBase and Investext. The market reports are from the following sources: Forrester Research, CSFB and Piper Jaffray.
A PPENDIX 4.3

Compilation of dataset

*/ SUMMARY OF SAS ALGORITHM:

input datasets:
1. Durationq: spreadsheet containing N rows with quarterly entry or censoring information and company characteristics
2. Marketq: spreadsheet containing T rows with sales information and total number of entrants for every quarter
3. States: spreadsheet containing N columns with geographical presence of companies
4. Entryq: spreadsheet containing T rows and N columns indicating if a company is present in the market at a given point in time

MARKET SIMILARITY ALGORITHM
1. create the market similarity matrix
2. create the market similarity time-dependent measures by starting do-loop over time
   a. read the relevant variable of the entry dataset and develop into a matrix
   b. combining the market similarity matrix with the entry matrix
   c. concatenate the market similarity measures in one matrix

RESOURCE SIMILARITY ALGORITHM
3. create a squared difference matrix for every relevant variable of resource similarity
   a. read the relevant variable from the duration dataset
   b. develop squared difference matrix
4. combine squared difference matrices for all relevant variables in the resource similarity measure
5. create the resource similarity time-dependent measures by starting do-loop over time
   a. read the relevant variable of the entry dataset and develop into a matrix
   b. combining the resource similarity matrix with the entry matrix
   c. concatenate the resource similarity measures in one matrix

SIZE SIMILARITY ALGORITHM
6. read the size measure
7. develop the size-similarity matrix
8. create the size similarity time-dependent measures by starting do-loop over time
   a. read the relevant variable of the entry dataset and develop into a matrix
   b. combining the size similarity matrix with the entry matrix
c. concatenate the size similarity measures in one matrix

COMBINATION INTO ONE DATASET ALGORITHM
9. concatenate similarity matrices
10. read duration dataset in matrix
11. read market dataset in matrix
12. convert market matrix in right form
13. concatenate duration, similarity and market matrix
14. read into a dataset

/* The algorithm first develops a similarity matrices between all companies. The relevant comparison-set is selected out of the similarity matrices. The similarity measures depend on time by the varying comparison-set of entered incumbents that the case is compared to (contained in dataset entryq). */

/* Duration contains one observation per company and expresses the time till censoring or entry as duration DUR. This duration expresses the length of time a company is in the risk set. The input variables are:
ID ID number of the case
DUR duration for which the case is in the risk set
ENTRY dummy variable that expresses whether the case entered */

/* The original dataset duration is expanded to add the time-dependent variables as different columns. Individual discrete time observations are then created from this */

proc iml;
USE states;
READ all INTO sts;

/* 6. create the market similarity matrix */
srel = t(sts[*, ]); /* N x N matrix of number of shared markets*/
snum = std[+, ]; /* row with number of states*/
scol = repeat(snum, ncol(snum), 1);
srow = t(scol);
stot = srow + scol - srel; /* N x N matrix of total states of pairs of cases*/
scom = srel / stot; /* element-by-element division to standardize market similarity */

/* 7. create the market similarity time-dependent measures by starting do-loop over time
a. read the relevant variable of the entry dataset and develop into a matrix
b. combining the market similarity matrix with the entry matrix
c. concatenate the market similarity measures in one matrix*/

USE entryq;
DO i=1 to 20;
    READ point i INTO ent; /* read row for time i */
    enttime = repeat(t(ent), 1, nrow(t(ent))); /* develop into n x n matrix*/
    scomrel = scom # enttime; /* element-by-element */
    simmktti = scomrel[<, ]; /* column-wise maximum set into vector-form */
/* NB the fact that the diagonals are always the maximum elements does not matter because the diagonal elements are cancelled out by the multiplication with enttime: the case itself will represent the maximum similarity value after it has entered; in the final dataset these data are cancelled out by right censoring through entry in the market */
    IF i = 1 THEN simmkt = simmktti;
    ELSE simmkt = simmkt || simmktti;
END;

/*---------------------------------------------------------------------*/
/* 8. create a squared difference matrix for every relevant variable of resource similarity
d. read the relevant variable from the duration dataset
e. develop squared difference matrix */

/* the following syntax is used for categorical variables*/
USE durationq:
READ all var [v1] into v1;
v1h = repeat(v1, 1, nrow(v1));  
/*matrix with row-wise cases*/
v1v = t(v1h);  
/* matrix with column-wise cases*/
v1dif = v1v-v1h;  
/* matrix of differences*/
v1dis = choose(v1dif=0, 0, 1);  
/* replace all non-zero elements by 1*/

/* the following syntax is used for categorical variables*/

USE durationq:
READ all var [v3] into v3;
v3h = repeat(v3, 1, nrow(v3));  
/*matrix with row-wise cases*/
v3v = t(v3h);  
/* matrix with column-wise cases*/
v3dif = v3v-v3h;  
/* matrix of differences*/
v3dis = choose(v3dif=0, 0, 1);  
/* replace all non-zero elements by 1*/

/* the following syntax is used for continuous variables*/

USE durationq:
READ all var [v4] into v4;
v4h = repeat(v4, 1, nrow(v4));  
/*matrix with row-wise cases*/
v4v = t(v4h);  
/* matrix with column-wise cases*/
v4dif = log(v4v)-log(v4h);  
/* matrix of differences*/
scale = max(abs(v4dif));  
/* scale of measure given by largest difference*/
v4dif01 = abs(v4dif)/scale;  
/* scale differences between 0 and 1*/
v4dis = v4dif01 ## 2;  
/* matrix of distances*/

USE durationq:
READ all var [v5] into v5;
v5h = repeat(v5, 1, nrow(v5));  
/*matrix with row-wise cases*/
v5v = t(v5h);  
/* matrix with column-wise cases*/
v5dif = log(v5v)-log(v5h);  
/* matrix of differences*/
scale = max(abs(v5dif));  
/* scale of measure given by largest difference*/
v5dif01 = abs(v5dif)/scale;  
/* scale differences between 0 and 1*/
v5dis = v5dif01 ## 2;  
/* matrix of distances*/

USE durationq:
READ all var [v8] into v8;
v8h = repeat(v8, 1, nrow(v8));  
/*matrix with row-wise cases*/
v8v = t(v8h);  
/* matrix with column-wise cases*/
v8dif = log(v8v)-log(v8h);  
/* matrix of differences*/
scale = max(abs(v8dif));  
/* scale of measure given by largest difference*/
v8dif01 = abs(v8dif)/scale;  
/* scale differences between 0 and 1*/
v8dis = v8dif01 ## 2;  
/* matrix of distances*/

USE durationq:
READ all var [v11] into v11;
v11h = repeat(v11, 1, nrow(v11));  
/*matrix with row-wise cases*/
v11v = t(v11h);  
/* matrix with column-wise cases*/
v11dif = log(v11v)-log(v11h);  
/* matrix of differences*/
scale = max(abs(v11dif));  
/* scale of measure given by largest difference*/
v11dif01 = abs(v11dif)/scale;  
/* scale differences between 0 and 1*/
v11dis = v11dif01 ## 2;  
/* matrix of distances*/

USE durationq:
READ all var [v13] into v13;
v13h = repeat(v13, 1, nrow(v13));  
/*matrix with row-wise cases*/
v13v = t(v13h);  
/* matrix with column-wise cases*/
v13dif = log(v13v)-log(v13h);  
/* matrix of differences*/
scale = max(abs(v13dif));  
/* scale of measure given by largest difference*/

A4.3-3
v13dif01 = abs(v13dif)/scale; /* scale differences between 0 and 1*/
v13dis = v13dif01 ### 2; /* matrix of distances*/

USE duration:
READ all var {v14} into v14;
v14h = repeat(v14, 1, nrow(v14)); /*matrix with row-wise cases*/
v14v = t(v14h); /* matrix with column-wise cases*/
v14dif = log(v14v)-log(v14h); /* matrix of differences*/
scale = max(abs(v14dif)); /* scale of measure given by largest difference*/
v14dif01 = abs(v14dif)/scale; /* scale differences between 0 and 1*/
v14dis = v14dif01 ### 2; /* matrix of distances*/

/* replace missing cases with distance=1 (=maximum distance between cases if a variable is unknown)*/

v1dis = choose(v1dis=., 1, v1dis);
v3dis = choose(v3dis=., 1, v3dis);
v4dis = choose(v4dis=., 1, v4dis);
v5dis = choose(v5dis=., 1, v5dis);
v8dis = choose(v8dis=., 1, v8dis);
v11dis = choose(v11dis=., 1, v11dis);
v13dis = choose(v13dis=., 1, v13dis);
v14dis = choose(v14dis=., 1, v14dis);

/* 9. combine squared difference matrices for all relevant variables in the resource similarity measure */
dif = sqrt(v1dis + v3dis + v4dis + v5dis + v8dis + v11dis + v13dis + v14dis);
maxdif=max(dif);
simress1 = 1-dif/maxdif;

/*10. create the resource similarity time-dependent measures by starting do-loop over time

f. read the relevant variable of the entry dataset and develop into a matrix
g. combining the resource similarity matrix with the entry matrix
h. concatenate the resource similarity measures in one matrix*/

USE entry:
DO i=1 to 20;
    READ point i INTO ent; /* read row for time i*/
    enttime = repeat(t(ent), 1, nrow(t(ent))); /* develop into nxn matrix*/
simrel = simress # enttime;
    simresti = t(simrel[<, ]); /* element-by-element */
    simresti = t(simresti[<, ]); /* column-wise minimum*/
    IF i = 1 THEN simres = simresti;
    ELSE simres = simres | simresti;
END;

/* 11. read the size measure */

USE duration:
READ all var {v5} into size;

/* 12. develop the size-similarity matrix */
sizel = repeat(size, 1, nrow(size)); /*matrix with row-wise cases*/
sizev = t(sizel); /* matrix with column-wise cases*/
sizedif = log(sizelv)-log(sizel); /* matrix of differences*/
scale = max(abs(sizedif)); /* scale of measure given by largest difference*/
sizedif01 = abs(sizedif)/scale; /* scale differences between 0 and 1*/
sizedis = sizedif01; /* matrix of distances*/
sizedis = choose(sizedis=., 1, sizedis);
sizesim=1-sizedis;

/* 13. create the size similarity time-dependent measures by starting do-loop over time
i. read the relevant variable of the entry dataset and develop into a matrix
j. combining the size similarity matrix with the entry matrix

A4.3-4
k. concatenate the size similarity measures in one matrix

USE entryq;
DO i=1 to 20;
    READ point i INTO ent;  /* read row for time i*/
    enttime = repeat(t(ent), 1, nrow(t(ent)));  /* develop into nxn matrix*/
    sizerel = sizesim # enttime;  /* element-by-element */
    simsziti = t(sizerel[,<>, ]);  /* column-wise*/
    IF i = 1 THEN simsize = simsziti;
    ELSE simsize = simsize || simsziti;
END;

/*COMBINATION INTO ONE DATASET ALGORITHM
14. concatenate similarity matrices*/
sim = simsize || simmkt || simres;

USE durationq;
READ all INTO duration;  /*15. read duration dataset in matrix*/

USE marketq;
READ all VAR {sales} INTO market;  /*16. read sales data in matrix*/
Mktsls=repeat(market, 1, nrow(duration));

mkt = t(mktsls) || t(mktent);  /*17. combine into market matrix*/

USE entryq;
READ all INTO entry;
USE durationq;
READ all var [v7] into size;
Size = repeat(t(size), nrow(entry), 1);  /* T xN matrix of rows of size observations*/
Sal = entry # size;  /* eliminate the non-entrants*/
Sal = t(sal[,<>, ]);  /* take maximum over entrants at every time*/
Sal = repeat(sal, nrow(duration), 1);

datamtrx= duration || sim || mkt || sal ;  /*18. concatenate duration, similarity, salience and market matrix*/

CREATE obsdataq from datamtrx;  /* create SAS datafile from matrix*/
APPEND from datamtrx;

QUIT;  /* end the iml-session*/

/*create a new dataset that contains discrete time observations for every quarter a company was in the risk set*/

DATA hazdata;
set obsdataq;
ARRAY simsz(* col18-col37;
ARRAY simmkt(*) col38-col57;
ARRAY simres(*) col58-col77;
ARRAY grw(*) col78-col97;
ARRAY cumentry(*) col98-col117;
ARRAY sal(*) col118-col137;
DO quarter=1 to col2 by 1;
    IF quarter=col2 AND col3=1 THEN event=1;
    ELSE event=0;
    simsize=simsiz(quarter);
    simmkt=simmkt(quarter);
    simres=simres(quarter);
totentry=cumentry(quarter);
growth=grw(quarter);
salience=sal(quarter);
OUTPUT;
END;
DROP col18-coll37;
RENAME col1 =ID;
RENAME col2 =dur;
RENAME col3 =entry;
RENAME col4 =bank;
RENAME col5 =cat;
RENAME col6 =desc;
RENAME col7 =states;
RENAME col8 =acc;
RENAME col9 =retrep;
RENAME col10 =cap;
RENAME col11 =off;
RENAME col12 =emp;
RENAME col13 =totrep;
RENAME col14 =rettot;
RENAME col15 =offst;
RENAME col16 =accost;
RENAME col17 =accrep;
RUN;