

DIVISIONALIZATION, PRODUCT CANNIBALIZATION AND PRODUCT
LOCATION CHOICE: EVIDENCE FROM THE U.S. AUTOMOBILE INDUSTRY

A Dissertation

by

EUI JEONG

Submitted to the Office of Graduate Studies of
Texas A&M University
in partial fulfillment of the requirements for the degree of

DOCTOR OF PHILOSOPHY

December 2003

Major Subject: Management

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Approved as to style and content by:

Javier Gimeno
(Co-Chair of Committee)

Albert A. Cannella Jr.
(Co-Chair of Committee)

Nikolaus T. Uhlenbruck
(Member)

Steven N. Wiggins
(Member)

Angelo S. DeNisi
(Head of Department)

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Major Subject: Management

ABSTRACT

Divisionalization, Product Cannibalization and Product Location Choice:

Evidence from the U.S. Automobile Industry. (December 2003)

Eui Jeong, B.B.A., Seoul National University;

M.B.A., Seoul National University

Co-Chairs of Advisory Committee: Dr. Javier Gimeno

Dr. Albert A. Cannella, Jr.

This study argues that a firm's product location choice may be a function of the firm's way of splitting the product market (i.e., divisionalization) and the concern for product cannibalization at the division and the firm levels. The focus of this study is at the division level and a division's new product location choice vis-à-vis its own products (intra-divisional new product distance), the products of a rival division of competing firms (inter-firm divisional new product distance), and the products of a sister division of the same firm (intra-firm divisional new product distance). The hypotheses were tested using data on the U.S. automobile industry between 1979 and 1999.

The results show that a focal division with a high level of inter-firm divisional domain overlap with a rival division, relative to the focal division's own domain, is more likely to locate its new product (here new car model) closer to that rival's existing car models. And it was also found that divisional density affects a division's new product location choice. But this study didn't find any significant role of divisional status on new product location choice. And contrary to our expectation, the results of intra-firm divisional domain overlap and new product location choice suggest that inter-divisional

product cannibalization might not be such an important concern when divisions introduce their new products, as we had originally expected.

By addressing the firm's competitive engagement in the context of a division's new product location choice, this study expands the basic logic of market overlap at the firm level into the unit- or division-level, and highlights how a division's new product location choice is affected by intra-firm divisional structural relationship as well as inter-firm divisional structural relationship. In so doing, this study hopes to contribute to the literature on divisionalization, new product location choice, competition at the unit-level, and product cannibalization, among others.

DEDICATION

*To
my mother Ji-Ja Nam and my father Yeon-deok Jeong
who gave me a world
and have filled it with love and hope*

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Buddha says that once you have crossed a river on a raft, you should let go of that raft. Since I am almost on the other side of a river, I think it is time to jump on the bank and release the raft on which I have been crossing the river called ‘the Ph.D. program at Texas A&M University.’ For a good swimmer or a seasoned rower, crossing a river may not be a serious endeavor. You could still swim to the other side in case the raft wrecks in the middle of the river; or you could still row to the other side even though turbulent waves threaten to engulf your raft. But for a person like me who does not know how to swim or row, the durability and reliability of the raft is the key for a successful crossing. Thus, it is not surprising for me to take this opportunity to thank ‘my raft’ before I finally let go of it.

First of all, I am grateful that I had the luck to have Javier Gimeno as my advisor and co-chair of the dissertation committee. From the moment I joined the program to this very moment, he has been a source of encouragement and inspiration. Without his understanding and patience, this dissertation would not have been possible. *Muchas gracias Javier!* And I could not forget my co-chair Bert Cannella for his constant support and understanding. I benefited not only from his insightful doctoral seminars, but also from his kind words and smiles. I was also lucky to have Klaus Uhlenbruck and Steven Wiggins on my dissertation committee, whose comments greatly improved the quality of the dissertation. My thanks to faculty members at Texas A&M University would not be complete without mentioning Mike Hitt, who has shown keen interest in my progress and well-being throughout the program.

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Lee has been special to me. The mere thought of his being in town used to give me a sense of comfort. Yangmin Kim showed what an exemplar doctoral student should be, of which I was always envious. And I could not forget my cohort. I would always cherish the memories of over-the-dinner-table discussions with Srikanth Goparaju and Antoine Monteils in numerous restaurants in College Station. And I will always remember Lucinda Lawson for her kindness and support.

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Finally, I cannot thank my family too much. They deserve all the credits out there but probably they don't need any recognition from me. My brother Minkyoo and sister-in-law Miran have always been supportive and encouraging. Their two children, Myung and Sol, have given me the laughs and joys that I have been desperately in need of. And my parents! My mother's never-ending prayers and my father's steadfast confidence have been the ultimate source of my perseverance and the prime mover of my adventures. My mother and father, to them I dedicate this dissertation.

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CHAPTER I

INTRODUCTION AND OVERVIEW OF THE RESEARCH

Motivation of the Research

When a firm introduces a new product in the market, it should consider how much similarity its new product should have in terms of product characteristics in comparison with rival products and/or its own existing products. A high degree of similarity to rival products may increase the demand of a new product but could trigger intense competition, whereas too much difference from rival products may relax potential price competition but could not attract customers who patronize rival products. In addition to these effects vis-à-vis competitors, a new product that has similar product characteristics or attributes to those of existing products may result in product cannibalization. Thus, choosing the product characteristics of a new product (i.e., product location choice) has significant ramifications on product market competition and internal competition, consequently, overall firm performance.

Industrial organization economists have addressed this issue under the topic of product differentiation (e.g., Hotelling, 1929; d'Aspermont, Gabszewicz, and Thisse, 1979; Shaked and Sutton, 1982). They have argued that the degree of product differentiation (i.e., from minimum differentiation to maximum differentiation) varies depending on such factors as the degree of competition, the distribution of demand within the product space, the order of entry, number of firms, and number of product dimensions or

characteristics, among others. For example, Hotelling (1929) demonstrated that, in a duopoly characterized with inelastic demand, linear transportation cost, homogeneous goods, and unequal prices, minimum differentiation is an equilibrium (i.e., two firms are paired at the center of the market and split the market). d'Aspermont, et al. (1979), however, showed that under quadratic transportation cost and elastic demand, maximum differentiation is an equilibrium outcome (i.e., firms locate their products as far apart as possible from their competing products). In a similar vein, some other studies showed that maximum product differentiation would occur as an equilibrium in the presence of price competition (Shaked and Sutton, 1982) or in the absence of subsequent entry by competitors (Prescott and Visscher, 1977).

It should be noted, however, that the models of product differentiation are generally quite basic (e.g., two-stage games with no repeated interaction, two firms with one or two products) and the results are quite sensitive to assumptions (e.g., simultaneous vs. sequential move, elastic vs. inelastic demand, Cournot vs. Bertrand competition). In reality, there are multiple firms in a market offering multiple products against multiple competing products. For example, when there are three firms, almost anything goes as an equilibrium (Bensaid and de Palma, 1994). And the literature on product differentiation has mainly focused on product differentiation between a focal firm and competing firms, but not on product differentiation among the products offered by the same firm. For a multiproduct firm, depending on how similar a new product is to other products of the same firm, the newly introduced product may *cannibalize* the firm's own existing products. Product cannibalization or cannibalism refers to a phenomenon or the extent to which the sales of a firm's new product reduces the sales of another product or other products offered by the *same* firm (Copulsky, 1976; Traylor, 1986; Mason and Milne, 1994).

Product cannibalization is an important phenomenon in new product introduction because it affects the revenue stream of new product introduction. The revenue streams from a new product introduction can be broken into three sources: revenues from market expansion, revenues taken from competing products, and revenues from other products offered by the same firm (Traylor, 1986). The first and the second sources represent revenues from direct effect and strategic effect of new product introduction, respectively (cf. Tirole, 1988), whereas the third represents cannibalized sales due to a new product introduction. The ideal situation would be the case when the third portion is zero, i.e., all new revenues come from expanding market and/or are taken from competing firms' sales. But this ideal situation is very hard to obtain since many firms offer multiple products and may launch variants of existing products through brand extension or line extension (Hardie, 1994; Reddy, Holak, and Bhat, 1994; Aaker and Keller, 1990), which may make cannibalization virtually inevitable. This is particularly true in very high competitive markets where new product introductions are a matter of course (Traylor, 1986; D'Aveni, 1994) and firms should preempt competitors by cannibalizing current competitive advantages with next-generation advantages (Nault and Vandebosch, 1998) before competitors steal the market. Therefore I believe cannibalization should be considered as an important factor in understanding firms' choice of product features (i.e., product location choice), product location choice, regardless of whether it is an error that should be avoided (Copulsky, 1976), or a strategic option for gaining or maintaining competitive advantages (Chandy and Tellis, 1998; Nault and Vandebosch, 1998).

Related to cannibalization, the literature on product differentiation has not paid much attention to the role of a division as an entity to develop and launch a new product into the market. Nowadays many large firms have multiple operating divisions and these divisions are responsible for developing and introducing a new product, and the deci-

sions that divisional managers make include price, product features, marketing, or procurement, among others (Chandler, 1995[1962]). When two divisions of the same firm offer very similar products, we may expect product cannibalization for the firm as a whole. But this does not necessarily mean that both divisions are cannibalizing each other: one division may cannibalize the other division's products, but not vice versa. In this case, this cannibalization would increase the former division's sales and possibly profits, but on the other division. Thus, we may expect that these two divisions might develop quite different attitudes or reactions to the cannibalization, which would affect their behaviors including product location choice. Therefore it is necessary to take into account how the structural relations between divisions affect their decisions of product location choice.

Based on this recognition, this study addresses product location choice of the firm that has multidivisional structure and the role of a division as an entity to choose the location of its new product (in product characteristics space). New product could be developed either by a single division or by cross-divisional project teams under the direction of corporate headquarters. In the former case, the location of a newly introduced product would fully reflect the focal division's interests or concerns. And in the latter case, we could expect that the location would reflect the firm-wide interests or concerns, but at the same time, it would also incorporate the interests or concerns of the focal division that is responsible for marketing the newly introduced product.

Scope of the Research

This study addresses product location choice from the perspective of a firm that has multidivisional (M-form) structure. M-form structure could be roughly characterized

as a divisionalized structure with an internal control apparatus (e.g., resource allocation, incentive design for division managers) in the hands of corporate headquarters (Williamson, 1975, 1985; Chandler, 1995[1962]). Among different types of M-forms (Williamson, 1975), the focus is on so-called pure M-form structure of type D_1 that represents a highly integrated M-form enterprise that produces (possibly) differentiated but otherwise common final products or services (e.g., automobile industry, PC industry, etc.). This type of M-form is different from the so-called pure M-form of type D_2 that denotes an M-form firm that produces diversified final products or services (e.g., General Electric).

Through divisionalization each division came to have its own divisional charter or domain. Divisional charter and domain refers to “the businesses (i.e., product and market arenas) in which a division actively participate and for which it is responsible within the corporation.” (Galunic and Eisenhardt, 1996: 256). Divisional charters are building blocks that constitute the corporate domain or organizational domain (cf. Thompson, 1967). (Hereafter the terms ‘domain’ and ‘charter’ are used interchangeably.) Divisional domains or charters are not once-and-for-all creations. At a point in time, divisional charters are explicitly fixed and recognized by other divisions and by corporate headquarters, but they change over time due to several reasons: the emergence of new business opportunities or growing unfit between divisional charters and relevant divisions’ capabilities, among others (Galunic and Eisenhardt, 1996, 2000). Or a division can increase or shrink its own charter by introducing new products or eliminating existing products.

The notion of a divisional domain implies that the way a firm splits its corporation domain into several divisional domains may affect the way the firm behaves in the market including its overall product location choice. Based on this recognition this study specifically focuses on three aspects that are closely related to divisional domains. First,

this study addresses the role of the status of a division in a firm in that division's new product location choice. Status is defined as the relative position of a division in a hierarchy of divisions in a firm on the dimensions of economic hierarchy, political hierarchy, and prestige hierarchy (cf. Benoit-Smullyan, 1944). Status is a relational characteristic that is defined in a network of relations; and here the relationship is among the divisions of the same firm. So there can be three types of status: economic status, political status, and prestige status (Benoit-Smullyan, 1944).¹ Status affects the behavior of the status holder at the individual, group, and organization levels. Individuals from different status show different behaviors (Moore, 1968, 1969; Leffler, Gillespie, and Conaty, 1982; Berger, Cohen, and Zelditch, 1972), the degree of status differences among groups affects the degree of conflicts among them (Manheim, 1960), and a wine producer's status in the market relative to competing firms affects that producer's decision on product quality (Benjamin and Podolny, 1999). So we may expect that a division's intra-firm status will affect that division's decisions and actions in general and product location choice in particular. Specifically this study expects that a higher status division would exercise more discretion in its product location choice than a lower status division due to its ability to garner more resources from corporate headquarters and its privileged positions against other lower status divisions in the firm.

Second, this study explores the implications of divisional domain overlap between a focal division and a rival division of a competing firm (inter-firm divisional overlap) on the focal division's decision on product location choice vis-à-vis the prod-

¹ In the context of market, Podolny (1993: 830) defines a producer's status as "the perceived quality of that producer's products in relation to the perceived quality of that producer's competitors' products." From Benoit-Smullyan's (1944) point of view, Podolny's (1993) definition is primarily close to prestige status and in some sense to economic status since a producer's status leads to better performance (cf. Benjamin and Podolny, 1999). In the case of the model of status-based market competition (e.g., Podolny, 1993, 1994; Benjamin and Podolny, 1999), the status of a firm is determined in the market, whereas in this study the status of a division is determined inside a firm.

ucts of that rival division. In general the literature on organizational ecology, IO economics, and strategic management suggests that the degree of divisional domain overlap between a focal firm and competing firms is positively related to the intensity of competition the focal firm experiences (Hannan and Freeman, 1977, 1989; Scherer and Ross, 1990; Tirole, 1988; Porter, 1980). This is because firms targeting similar markets have similar resource requirements, which increases the potential for competition.² Some of prior studies on new product introduction also show that differences in market share matter in new product introduction in general (Mitchell, 1989; Christensen and Bower, 1996) and product location choice in particular (Eaton and Lipsey, 1979; Thomas and Weigelt, 2000). The argument of divisional charter or domain (Galunic and Eisenhardt, 1996, 2000) or organizational domain (Thompson, 1967) also suggests that the resource requirements of a focal division should be quite similar with those of a rival division that serves similar domain or charter. So this study expects that the degree of resource requirements overlap between a focal division and rival divisions would affect the focal division's product location choice.

Third, this study examines the impact of divisional domain overlap between a focal division and another division of the same firm (intra-firm divisional overlap) on the focal division's product location choice. From the firm's point of view, domain overlap between divisions of the same firm implies the existence of product cannibalization. But from a focal division's perspective, firm-level cannibalization does not necessarily mean

² Even though the breadth of overlapped market increases, the intensity of competition may not increase proportionately because the competition may be diffuse over a greater scope of markets and the need for mutual forbearance also increases (cf. Edwards, 1955; Gimeno and Woo, 1996; Baum and Korn, 1996). However, it also should be mentioned that mutual forbearance works well when market boundaries are well defined (Singal, 1996), among others. But in a differentiated industry, which this study is concerned with, products are usually related to one another, i.e., the demands of two separate products are related through the products between the two (Schmalensee, 1978; Gabszewicz), which may suppress mutual forbearance.

‘cannibalization’ of its own (i.e., intra-divisional cannibalization) as long as the focal division does not cannibalize its own existing products due to its new product. In other words, if the focal division’s new product takes sales from the products of other divisions of the same firm (i.e., inter-divisional cannibalization), this becomes product cannibalization for the firm, but it is not a cannibalization for the focal division. This intriguing nature of cannibalization at the firm and division levels may provide some clues in understanding divisions’ product location choice.

The literature on product cannibalization suggests that it should be avoided in general (e.g., Copulsky, 1976), which may suggest that high degree of division domain overlap would lead divisions in question to locate their new products away from other divisions of the same firm, either forced by corporate headquarters or voluntarily by the divisions. However, the literature also indicates that under certain circumstances cannibalization can be a strategic option (Traylor, 1986; Chandy and Tellis, 1998; Kerin, Harvey, and Rothe, 1978), which may imply that intra-firm divisional domain overlap would not necessarily lead divisions to locate their products far away from the products of other divisions. The study expects that the portion of overlap from the perspective of a focal firm and the firm’s attitude toward cannibalization would affect the focal division’s product location choice vis-à-vis the products of other divisions in the firm.

In summary, this study addresses product location choice from the perspective of a division in the firm that has multidivisional structure (type D_1): a focal division’s status, the degree of division domain overlap between a focal division and a rival division (inter-firm divisional overlap), and the degree of divisional domain overlap between a focal division and a sister division of the same firm (intra-firm divisional overlap).

Basic Research Questions

This study addresses the following basic research questions.

1. How does a division's intra-firm status relative to other divisions of the same firm affect the division's product location choice?
2. How does the degree of divisional domain overlap between a focal division and a rival division of competing firms (i.e., inter-firm divisional overlap) affect the focal division's product location choice?
3. How does the degree of divisional domain overlap between a focal division and another division of the same firm (i.e., intra-firm divisional overlap) affect the focal division's product location choice?

To address these questions, this study will synthesize (1) literature on multidivisional structure developed in strategic management field and economics; (2) sociological literature on status; (3) literature on product differentiation accumulated in IO economics; and (4) product cannibalization arguments from marketing and economics.

Contributions of the Research

By addressing the impact of divisionalization on product location choice using the arguments of multidivisional structure, product differentiation, status, and product cannibalization, this study contributes to the literature of strategic management in several important ways. First, this study is expected to enrich the literature on product differentiation. Up to now the majority of research on product differentiation has been done from IO economics perspectives (e.g., Hotelling, 1929; d'Aspremont, et al., 1979; Prescott and Visscher, 1979; Shaked and Sutton, 1982; Eaton and Lipsey, 1979; Brander and

Eaton, 1984). By incorporating the perspectives of sociology, strategic management, and marketing, this study contributes to the body of knowledge on product location choice. Basically this study adds a couple of arguments in understanding a firm's product location choice. This study demonstrates that the way a firm splits its product market scope affects the overall product location choice of the firm. This is because through divisionalization the firm shapes (1) the relationship between the general office and divisions, (2) the structural relationship between its own divisions and the divisions of competing firms, and (3) the structural relationship among its own divisions inside the firm. And the concern for intra-divisional and inter-divisional product cannibalization, along with the structural relationships, also plays a role in explaining a division's product location choice.

Second, this study is expected to provide some evidence on the impact of organizational structure on firm behavior and thereby provides evidence to the hypothesis that strategy follows structure. Unlike the argument that structure follows strategy, the hypothesis that structure affects strategy has not drawn sufficient attention from scholars in the strategic management field. It is very hard to find studies that directly address the hypothesis (Notable exceptions are Hoskisson and Hitt (1988) and Argyres (1996)). Rather, scholars have paid attention to the relationship between organizational structure and firm performance (e.g., Armour and Teece, 1978; Hill, 1985; Hoskisson and Galbraith, 1985; Teece, 1981), or the moderating role of diversification strategy on the relationship between organizational structure and firm performance (e.g., Hill and Hoskisson, 1987; Hill, Hitt, and Hoskisson, 1992; Hoskisson, 1987). Some other scholars studied the moderating effect of SBU strategy on the relationship between decentralization and SBU effectiveness (Gupta, 1987; Govindarajan, 1986). However, they did not address the direct relationship between organizational structure and SBU competitive

behavior, either. In sum, most of the relevant studies have not focused on the impact of structure on firm strategic behavior, but they rather focused on (1) the direct effect of organizational structure on performance; or (2) the implications of organizational structure on performance from the perspective of contingency theory.

Third, related to the above, the study will contribute to the literature on competitive dynamics by exploring another source of competition: divisionalization and product cannibalization. Regarding the sources of competition, scholars have found out that the following factors matter: top management team composition (e.g., Hambrick, Cho, and Chen, 1996), the similarity of resource profiles and strategies among firms (e.g., Chen, 1996; Gimeno and Woo, 1996), market commonality (e.g., Chen, 1996; Gimeno and Woo, 1996, 1999; Gimeno, 1999), strategic group membership (e.g., Caves and Porter, 1977; McGee and Thomas, 1986), and past performance (Miller and Chen, 1994; Greve, 1998), among others,. However, scholars have not paid sufficient attention to the role that divisionalization may play in the firm's competitive actions.

Organization of the Research

This study is organized as follows. First, in Chapter 2, I review the IO economics literature on product differentiation and the strategic management literature on business units. This review provides theoretical and empirical research findings related to these topics. In so doing, the arguments and empirical findings are summarized and critically evaluated. It should be noted, however, that the review is not exhaustive.

Second, in Chapter 3, I present a theoretical framework and hypotheses that explain the impact of divisionalization and product cannibalization on product location choice. The theoretical framework is based on the arguments of product cannibalization

in marketing and economics, product differentiation in industrial organization, status in sociological literature, and organizational niche in organizational ecology.

Third, Chapter 4 introduces research methods for the study. This chapter describes sample and data, and presents operational definitions of the variables. And this chapter presents statistical models and techniques for various estimations, including those for testing the hypotheses laid out in the previous chapter.

Fourth, in Chapter 5, I report the results of the analyses. Here I start with some preliminary analyses and their results that are necessary for the main analyses of the study. Specifically I report descriptive statistics and correlation tables, and the results of hypotheses testing, among others. And I also provide proper interpretations of the estimates.

Finally, Chapter 6 discusses the implications of the results. The implications are not restricted to statistically significant results; they also address the results that didn't receive statistically significant support (i.e., either statistically non-significant or significant but with the wrong direction in terms of the sign of the coefficients), but could help us better understand the firm's new product location choice at the division level. This chapter also discusses some caveats in interpreting the results. In addition to the caveats, this chapter also suggests several future research directions out of the current research. This chapter concludes with an executive summary.

CHAPTER II

LITERATURE REVIEW

Introduction

In this chapter I review the literature on product location choice and business units. The literature review is not intended to be exhaustive but is focused on prior works that are relevant for the current study. First, the chapter reviews the extant literature on product location. The literature on product location choice or product differentiation has been accumulated mainly in IO economics after Hotelling's (1929) seminal work on spatial product differentiation. I focus on the basic notions of product differentiation and review the literature on the basis of theoretical assumptions. Since there are several excellent works that have documented the developments of this topic, the focus will be on the key issues on product differentiation.

Second, the chapter reviews some of the prior works that addressed the business unit of the firm. I don't intend to provide an exhaustive review on the literature that addresses organizational structure. Rather the chapter specifically focuses on some recent works that have addressed organizational structure and its impact on business unit strategy or outcome.

Product Differentiation

When firms announce that they will introduce a new product that is 'different' from competing products in the market, what do they mean by 'different'? If a product

can be regarded as a bundle of characteristics (e.g., Lancaster, 1979), what differentiates a certain product from others is the characteristics that it possesses (Beath and Katsoulacos, 1991; Tirole, 1988; Eaton and Lipsey, 1989). For example, Toyota Camry, Honda Acura, and Ford Taurus belong to the same market segment classified by *Automotive News*. But these three products are different from one another in terms of their respective length, width, height, horsepower, or fuel efficiency, etc. So if we can represent each characteristic as a dimension in n -dimensional characteristics space, a product can be thought of as a point consisted of the n -values of n -characteristics. Thus, the distance between any two products in product characteristics space represents the degree of differentiation between the two products.

Then why do firms want to differentiate their products from their competitors' products or rival products? An immediate answer would be that sufficient product differentiation allows firms to be a monopolist in relation to its own product without the worry of intense price competition (Gabszewicz and Thisse, 1986a; Brander and Eaton, 1984). However, if a firm differentiated its products too much from rival products, this may restrict its ability to compete effectively in its competitors' product markets (Gabszewicz and Thisse, 1986a). Thus, the firm has incentives to differentiate its products, however within certain limits. Beath and Katsoulacos (1991: 6) point this out as follows:

If firms in a particular group produce goods which are differentiated, the product of the different firms are imperfect substitutes for each other and, as we hinted earlier, this gives each firm the potential to act as a monopolist in relation to its own product. It is this potential for monopoly profits, due to the fact that it reduces the sensitivity to competitive moves, that provides firms with the basic incentive to differentiate their product. However while differentiation enables a firm to insulate its own market to a symmetric one, and it also makes it harder for the firm to effectively compete in its rivals' own markets. Hence differentiation may well cut it off from a much larger market.

The literature on product differentiation accumulated in IO economics is the result of addressing some ‘awkward facts’ that we can easily find in the real world. These awkward facts have constrained theorizing about product differentiation (Eaton and Lipsey, 1989: 725-726). These facts include (1) many industries, including most that produce consumers’ goods, produce large number of similar but differentiated products; (2) the consumers’ goods produced by different firms in the same industry are differentiated from one another so that two products produced by two different firms are rarely, if ever, identical; (3) the set of products made by firms in any one industry is a small subset of the set of possible products; (4) in most industries each firm produces a range of differentiated products; (5) any one consumer purchases a small subset of the products that are available from any one industry; (6) consumers perceive the differences among differentiated products to be real and there is often approximate agreement on which ones are, or are not, close substitutes; and (7) tastes are revealed to vary among consumers because different consumers purchase different bundles of differentiated commodities and these differences cannot be fully accounted for by difference in their incomes. According to Eaton and Lipsey (1989), the literature on product differentiation is the result of answering questions that are related to the above-mentioned awkward facts: the processes that gave rise to these facts? the positive and normative implications of these facts?

There are many studies that provide a comprehensive or succinct overview of the core idea and development of product differentiation in IO economics: Eaton and Lipsey (1989), Gabszewicz and Thisse, (1986b), Beath and Katsoulacos (1991), Gabszewicz (1999), and Greenhut, Norman, and Hung (1986), Lancaster (1990) among others. Thus, this study does not provide an exhaustive review of the current literature on product differentiation accumulated in IO economics. Rather than providing a comprehensive re-

view on product differentiation, this study addresses major points of the literature following major works in this field.

Depending on the approaches to consumers' preferences on the demand side of the problem of product differentiation, the literature classifies horizontal product differentiation into two branches: address vs. non-address branch (Archibald, Eaton, and Lipsey, 1986). Address branch posits "a distribution of consumers' tastes over some continuous space of parameters describing the nature of products. Different consumers have different most preferred locations in this space and thus can be thought of as having different *addresses* in that space. Products are also defined by their addresses in the space, and this makes the set of all possible products infinite" (Eaton and Lipsey, 1989: 727). And consumers choose the product that is closest to their most preferred location in the product characteristics space. Since Hotelling's (1929) seminal work, most of the works on product differentiation have followed this approach. Non-address branch posits that "consumers' preferences for differentiated goods are defined over a predetermined set of all possible goods, which may be finite or countably infinite" (Eaton and Lipsey, 1989: 728). Chamberlin's (1933) monopolistic competition is consistent with this branch. With respect to consumers' purchase of differentiated goods, this branch has been addressed either by the representative consumer approach (e.g., Spence, 1976a, 1976b; Dixit and Stiglitz, 1977) or diverse consumer tastes approach (e.g., Perloff and Salop, 1985). This study is primarily concerned with address branch of the product differentiation models since the majority of studies on product differentiation belong to this branch. For a succinct summary of the difference between address and non-address branches, readers are referred to Eaton and Lipsey (1989) and Archibald, et al. (1986). This study focuses on address branch which was started by Hotelling's (1929) seminal work.

Several main features of product differentiation

The current IO literature on product differentiation exhibits several interesting features (Eaton and Lipsey, 1989; Gabszewicz, 1999; Gabszewicz and Thisse, 1986b). First, the models are very simple. Most studies rely on 2-stage game theoretic models where firms choose product location in the 1st stage and then choose either price or quantity in the 2nd stage of the model. And the majority of models is based on a duopoly situation where each firm is a single-product firm and the product has one-dimensional characteristic. Second, the results are very sensitive to ad hoc assumptions of the models: simultaneous move vs. sequential move, price competition vs. quantity competition, elastic demand vs. inelastic demand, or linear transportation cost vs. quadratic transportation cost, among others. For example, the assumption of quadratic transportation cost amplifies the effects of price competition compared with the assumption of linear transportation cost. Third, when the models incorporate some realities in their specifications, the results are unconventional. For example, when the models assume that a product can have more than one product characteristic, the results show that both maximum and minimum differentiation could happen in a single product. And when the models assume multiple firms introducing multiple products, it is very hard to obtain clear-cut results, say either maximal or minimal differentiation.

The following review on the literature provides these features in detail. The review proceeds according to different assumptions or settings that have been addressed in the literature. For a more detailed and complete treatment of the literature on product differentiation, readers are referred to Eaton and Lipsey (1989), Gabszewicz and Thisse (1986b), Gabszewicz (1999), and Beath and Katsoulacos (1991), among others.

One-dimensional product characteristic and duopoly

The literature on product differentiation practically started with Hotelling's (1929) model of spatial competition. Hotelling (1929) starts with the recognition that, contrary to the tacit assumption, a firm that charges a higher price over homogeneous products does *not* lose all of its sales instantaneously. To examine this intuition, he assumed several properties of a duopoly of homogeneous goods: (1) customers are uniformly distributed along a *line* of finite length (say a main street in a town); (2) each firm chooses a location simultaneously (and then engage in Bertrand competition); (3) customer demand is extremely *inelastic* (consumers consume one unit or zero per unit of time irrespective of the price); (4) consumers incur a transportation cost t per unit of length (thus, total cost for consumers consists of mill price and transportation cost); (5) consumers don't have any preference over either firm except for price and transportation cost; and (6) production cost is zero. And two firms choose price and location in such a manner to maximize their profits. Based on the above assumptions, Hotelling (1929) demonstrated that two firms would locate themselves at the center of the line (i.e., market) and split the market into two halves (each half for each firm): principle of minimal differentiation. It should be noted that this equilibrium outcome is not consistent with the social optimum that minimizes transportation cost for consumers: social optimum occurs when two firms locate at the first and the third quartiles.

Unlike Hotelling (1929), Smithies (1941) assumed conjectural variation and elastic demand. He demonstrated that the concern for conjectural variation – a competitor's reaction by changing price or by changing both price and location – would make firms locate toward the center while not to the point of minimum differentiation; and with elastic demand, firms have incentives not to move too much toward the center since this will result in the loss of customers near the end of the market, which mitigate the ten-

dency toward minimum differentiation. Related to Smithies' (1941) assumption of linear demand, Nero (1999) also shows that under linear demand and a two-stage game (location-price), duopolists have incentives to relax price competition through maximum product differentiation when the *reservation price* is high enough.

The biggest challenge to Hotelling's (1929) principle of minimum differentiation came a half a century later by d'Aspremont, et al. (1979) who showed that Hotelling's (1929) equilibrium is not equilibrium. They showed that at least one firm has an incentive to maximize its profits by raising or undercutting its own price. When two firms are located very close to each other (i.e., their products are quite similar to each other), price competition would intensify. In this case, at least one firm can increase its profits either (1) by relocating its position farther from the other and raising its price; or (2) by relocating its position (i.e., product) infinitesimally closer to the competing product and undercutting its own price. Thus, d'Aspremont, et al. (1979) suggest that minimum differentiation could not be an equilibrium outcome since no price equilibrium solution exists unless both firms are sufficiently far apart from each other. As an alternative outcome, they took an example when transportation costs are not linear per unit length but quadratic. They demonstrated that when transportation cost is quadratic, the equilibrium outcome is not minimum differentiation but maximum differentiation to relax price competition. It is now a well-known fact that the assumption of quadratic transportation costs magnifies the effect of price competition.

d'Aspremont, et al's (1979) equilibrium outcome of maximum differentiation was challenged by Bester (1998). He argues that when the quality is uncertain and consumers rely on observed prices to ascertain the quality of products, the equilibrium outcome would be minimal differentiation. This is because consumers' imperfect information about the quality characteristics of products reduces firms' incentives to horizontally

differentiate their products from rival products. His analysis is on experience goods. In sum, Bester (1998) supports the idea of head-on competition. This argument is close to the arguments when price is exogenous. In this case, price is very rigid due to its quality signaling property. As prices become rigid due to signaling reasons, firms would enjoy positive profits and they become less motivated to relax price competition through product differentiation. The author further argues that this line of reasoning could be applicable to vertical differentiation (cf. Shaked and Sutton, 1982).

In a slightly different vein, Bockem (1994) challenges both Hotelling (1929) and d'Aspremont, et al. (1979). According to Bockem (1994), both demand-increasing effect of minimum differentiation (Hotelling, 1929) and price-relaxing effect of maximum differentiation (d'Aspremont, et al., 1979) are algebraic accidents. He demonstrates that when consumers have an outside option (i.e., if consumers' choice set is expanded), in equilibrium neither minimum nor maximum differentiation will occur.

For a vertical product differentiation, Shaked and Sutton (1982) argue that maximal differentiation is an equilibrium outcome. In a three-stage game model of vertical differentiation (entry-quality-price), Shaked and Sutton (1982) demonstrate that market equilibrium occurs when two potential entrants choose to enter the market; these two firms choose their respective products maximally differentiated from each other's product; and these two firms make positive profits. Firms differentiate their products in terms of quality to relax price competition. When there are more than three firms, no firm will enjoy positive profits since competition in quality would drive all firms to produce the same top level of quality permitted while prices and profits become zero. One of the noteworthy assumptions of this model is that the upper-bound of income is twice the lower-bound income.

Gabszewicz and Thisse (1979) also examined the effect of income dispersion on vertical product differentiation. In a duopoly game, they assumed that consumers have identical tastes but different income levels, firms produce products at no costs and provide relatively close substitutes, and consumers make indivisible and mutually exclusive purchases. Upon these assumptions, they derived the results that duopolists would have incentives to choose quality such that they maintain product differentiation from each other, i.e. from a sufficient degree to maximal product differentiation.

In sum, in a two-stage duopoly game where each firm produces one product with single characteristic, what matters is whether (1) price is endogenous or exogenous; (2) demand is elastic or inelastic; or (3) price competition is intense or not (i.e., the form of transportation costs). When prices are endogenously decided, equilibrium outcome is hard to gain at least in horizontal differentiation (d'Aspremont, et al., 1979), unlike the case where prices are assumed to be quite rigid (Hotelling, 1929; Best, 1998). These studies further suggested that the (potential) existence of intense price competition would make firms differentiate their product from at least a sufficient degree to maximum degree from competing products to relax intense price competition (d'Aspremont, et al., 1979; Shaked and Sutton, 1982; Nero, 1999). These studies also demonstrate that when the demand is elastic, firms have more incentives to differentiate their products (Nero, 1999; Smithies, 1941). Thus, these results basically suggest that when price competition is a concern and demand is elastic, which is usually the case, firms have incentives to differentiate their products from competing products from a sufficient degree to the maximum degree.

Multi-dimensional product characteristics and duopoly

Some studies have focused on the case where products can have more than one characteristic. For horizontal differentiation, some studies showed that firms would pur-

sue maximal differentiation in one dimension and minimal differentiation in the other dimension(s). Irmen and Thisse (1998) show that, in a duopoly under the assumption of quadratic transportation costs, the principle of minimal differentiation holds for all product characteristics except for one characteristic. Duopolists choose to maximize differentiation in the dominant characteristic (the characteristic with the largest or sufficiently large salience coefficient) but minimize differentiation in the other characteristics. Ansari, Economides, and Steckel (1998) also show the same results in 2- and 3-dimensional characteristics spaces. They show that under quadratic transportation costs, duopolists choose maximum differentiation on one dimension (the characteristic that consumers put the highest weight) and minimum differentiation on other dimensions. In the case of minimum differentiation, firms cluster at the center of the characteristics in question.

Vandenbosch and Weinberg (1995) demonstrate that the same result shown in horizontal differentiation holds for vertical differentiation. In a two-stage game (quality-price) with two-dimensions of product characteristics, they show that in a duopoly, a firm chooses its product such that its product is maximally differentiated from rival product on one dimension, but minimally differentiated on the other dimension. One peculiar characteristic of the study is the incorporation of position-dependent variable costs. This study is an extension of Shaked and Sutton (1982) that deals with one-dimension vertical differentiation.

In sum, the studies on multiple product characteristics suggest that, unlike one-dimensional product characteristic, firms have multiple means to differentiate their products. This implies that depending on what characteristics are included in the equation, we may have quite different results. So we may wisely include characteristics that consumers put equally high importance on (Ansari, et al., 1998) and that are expensive to produce (Vandenbosch and Weinberg, 1995).

Multiple products or multiple firms and product differentiation

Up to now I have reviewed the studies that have primarily focused on a duopoly where each firm has one product that has either one characteristic or multiple characteristics. However, firms usually produce more than one product and compete against multiple rival products in the market, and there may be more than two firms in the market. Researchers have tried to incorporate this reality in their studies on product differentiation.

From the demand-side of product selection using non-address approach, Brander and Eaton (1984) model product line rivalry in a duopoly where each firm produces four possible products in a three-stage game (scope-location-quantity). Among the four products, two products are close substitutes for each other and are distant substitutes for the other pair, which are close substitutes for each other (say the pairs of (1,2) and (3,4) are close substitutes, whereas the pairs (1,3) or (2,4) are more distant substitutes). They show that when a firm is guaranteed a monopoly over a range of products, it will seek to launch products that are most distant substitutes of its current product lines. But when a range of potential products is limited to a group of established competing firms, i.e., under intermediate levels of demand, each firm is more likely to seek to launch products that are close substitutes of its current products (segmented market structure). In so doing each firm expects to avoid intense price and output competition at a later stage. And when there exists a threat of entry by outsiders, each firm would seek to develop products that are more distant substitutes (interlaced market structure), which would increase competition that would deter potential entry. Thus, Brander and Eaton (1984) suggest that in a growing market, the market structure may evolve from a monopoly, a segmented duopoly, and an interlaced oligopoly.

Martinez-Giralt and Neven (1988) question Brander and Eaton (1984) by arguing that when price competition is intense, the question of endogenous multiple outlets competition is void. In a two-stage game (location-price) of a duopoly with quadratic transportation costs, they demonstrated that firms would locate their outlets as close as possible to each other (and will optimally collapse the outlets into a single point), whereas they locate their outlet as far away as possible from a rival outlet (maximum differentiation). This result holds both in a circular and a linear paradigm. Therefore, neither firm takes up the opportunity to open two outlets in order to relax price competition (no product line rivalry), i.e., the incentive to relax price competition dominates the incentive to segment the market. The assumption of quadratic costs is crucial for the results since this function generates the most intense price competition.

Related to Martinez-Giralt and Neven (1988), from the recognition that the maximal differentiation is due to the assumption that firms are allowed only two outlets, Gabszewicz and Thisse (1986b) addressed the case where duopolists are allowed to introduce as many outlets (in this case plants) as they want. They found that the equilibrium location is the one that duopolists differentiate their own outlets but locate their outlets next to their competitors' outlets. Going one step further from Gabszewicz and Thisse (1986b), Bensaid and de Palma (1994) show that when there are three firms that can have two products, almost anything goes as an equilibrium outcome. In a two-stage model (location-price), Bensaid and de Palma (1994) suggest that maximum differentiation may be due to the assumption that there are only two firms. They examined the situation where three firms locate themselves up to two outlets and found that almost anything goes as an equilibrium when there are three firms: reduced differentiation, maximal differentiation, and a variety of outcomes in between these two extremes.

Under the assumption of sufficient product and consumer heterogeneity, de Palma, Ginsburgh, Papegeorgiou, and Thisse (1985) showed that minimum differentiation at the center of the market is always an equilibrium outcome regardless of the number of firms in an industry. Here equilibrium prices are positive proportional to the degree of heterogeneity. This study is to test the sensitivity of minimum differentiation with respect to homogeneity of products and consumers. But they also assume linear transportation cost and uniform distribution of consumers.

In summary, when there are multiple firms with multiple products in the market, equilibrium is either hard to obtain or there may be infinite numbers of equilibrium (Brander and Eaton, 1984; Bensaid and de Palma, 1984). When firms compete with multiple competitors, firms not only consider how much they will differentiate their new products from rival products, but also take into account how close they will locate their new products in comparison with their current products. Thus, in addition to product differentiation relative to rival products, product cannibalization should become an important concern in new product introductions for multiple product firms.

Sequential entry and product differentiation

Most of the studies on product differentiation have assumed that firms move simultaneously. Several studies have addressed the case when firms move or enter sequentially. One important study on sequential entry and product differentiation is Prescott and Visscher (1977). Under the assumption of foresighted sequential entry and costly relocation, Prescott and Visscher (1977) demonstrate the following results: (1) in location competition alone in a duopoly, i.e., conventional Hotelling-type model, the equilibrium is minimum differentiation at the center; for three firms, the equilibrium is that first two firms locate at the first and the third quartiles and the third firm locates between the two

firms; (2) under endogenous entry, the first two firms will locate themselves symmetrically from the two ends of the market, respectively, and subsequent firms locate themselves sufficiently far away from the nearest firm until it is no longer profitable; (3) under location and price competition, i.e., true Hotelling (with some modification to guarantee the existence of an equilibrium), maximum differentiation is an equilibrium outcome for a duopoly and no equilibrium when there are three firms; and (4) under higher fixed cost of entry, the second entrant has incentives to locate as far away as possible from the first entrant since higher-fixed cost of entry serves as a barrier to entry.

And under the assumption of sequential moves and a Stackelberg framework, Anderson (1987) demonstrates that the first firm locates at the center of the market and the second firm locates itself close to one of the ends of the spectrum. Thus, the equilibrium location is asymmetric, which is due to the nature of sequential entry.

In sum, the above studies suggest that firms' decision on new product location is dependent upon how current competitors position their products in the market and/or how potential entrants would position their products if they entered the market.

Other issues of product differentiation

In addition to the issues addressed up to now, the literature on product differentiation addresses several important issues. These issues include the stability of equilibrium, the number of (optimal) firms in a differentiated industry, entry deterrence, and the relationship between horizontal and vertical differentiation, among others. With respect to the stability of equilibrium in horizontal and vertical differentiation, Gabszewicz and Thisse (1986a) show that there exist no (stable) price and location equilibrium under horizontal differentiation, whereas there always exists a stable price and location out-

come under vertical differentiation. This [price equilibrium] is primarily due to the fact that concavity of demand almost never holds under horizontal differentiation, whereas the concavity of demand almost always holds under vertical differentiation.

The number of firms is also an important issue in product differentiation because, under the assumption of a single-product firm, it determines the variety of products of an industry. With respect to vertical differentiation, Shaked and Sutton (1983) argue that, under the assumption that all qualities are produced and sold at marginal cost and consumers would buy the highest quality, there can be at most a finite number of firms with positive market share in the industry since price competition among high-quality producers would drive prices down, which ultimately pushes low-quality producers out of the market (so called finiteness property). Considering the entry in a vertically differentiated industry, Gabszewicz and Thisse (1980) derived the number of firms that could coexist in the industry. When the upper bound is reached, any entry will lead to an exit by an existing firm in an industry, thus the number of firms is maintained. And entry would drive equilibrium prices to the level of competitive ones. This finiteness property in vertical differentiation is different from what we can find in horizontal differentiation. In horizontal differentiation, the equilibrium number of firms goes to infinity when entry cost becomes zero and the density of consumers tends to infinity (see Tirole, 1988).

Regarding the entry in a differentiated industry, Schmalensee (1978) found that an incumbent firm could deter entry by proliferating brands since brand proliferation would leave no profitable niche for potential entrants. Eaton and Lipsey (1979) also demonstrated that, in a growing market, a foresighted monopolist would preempt potential entry by introducing a new product before a rival does. Judd (1985) questions the entry deterrence by brand proliferation (Schmalensee, 1978) by arguing that a potential entrant still can successfully enter if it can induce the incumbent to vacate one or more ad-

dresses—a strategy of predatory entry—by either matching its new product to a rival product or locating it between the two rival products. For Judd (1985), what matters is exit cost rather than sunk cost itself when an incumbent firm decides whether to pull out a product.

Traditionally horizontal differentiation and vertical differentiation have been treated separately. However, several studies suggest that they are more closely related to each other than we have thought. Cremer and Thisse (1991) argue that, under mild assumptions on the transportation cost, any Hotelling-type model (horizontal product differentiation model) is a special case of vertical product differentiation: the product locations in an equilibrium in the horizontal differentiation model are the qualities in an equilibrium model in the vertical differentiation model. However, the opposite does not necessarily hold (cf. Shaked and Sutton, 1983). Anglin (1992) also argues that the often cited difference between vertical and horizontal differentiation—all consumers agree on the ranking of types in a vertically differentiated market, whereas they disagree in a horizontally differentiated market—is less important in most cases. And “[t]he interesting results in a vertically differentiated market do not arise from any agreement among consumers on the ranking of quality because any effect of such agreement can be offset by prices and the cost of production when consumers are concerned with price *and* quality.” (Anglin, 1992: 12) Thus, the decision rules that consumers use in a vertically and a horizontally differentiated market are the same due to income and substitution effects that occur due to a price change.

In sum, the existing literature on product differentiation suggests that firms have incentives to maintain from the minimum to the maximum level of differentiation. And, the degree of differentiation is contingent upon the intensity of price competition, the number of firms, the number of products, the nature of demand, or the way firms (poten-

tially) position their products in the market. However, what is missing here is that nowadays firms have multiple divisions and each division is responsible for managing a range of products. Thus, each division has its own competing products, and should interact with other divisions of the same firm in terms of resource allocation and divisional character change under the same corporate headquarters. This may pose a new issue in understanding product location choice compared with the existing literature that exclusively focuses on the firm as a unifying whole, which forms the basis of the theoretical arguments and testable hypotheses that are presented in the next chapter.

Organizational Structure, Strategy, and Business Units

Organizational structure and strategy

Regardless of whether we favor “structure follows strategy” over “structure contains or follows strategy,” or vice versa, it is universally agreed upon among scholars that structure and strategy are closely related to each other. Chandler’s (1995 [1962]) pioneering work on the emergence of M-form structure in the business world has been regarded as a representative of the former hypothesis and has inspired many works since then. What is interesting is that Chandler (1995[1962]) himself actively recognized the impact of structure on strategy.

Thus structure has as much impact on strategy as strategy had on structure. But because the changes in strategy came chronologically before those of structure, and perhaps also because an editor at The MIT Press talked to me into changing the title from *Structure and Strategy* to *Strategy and Structure*, the book appears to concentrate on how strategy defines structure rather than on how structure affects strategy. My goal from the start was to study the complex interconnections in a modern industrial

enterprise between structure and strategy, and an ever-changing external environment.(Chandler, 1995[1962]: Introduction)

Structure has an impact on strategy by influencing the flows of information and the way organizational participants interact with one another (Miller, 1987; Fredrickson, 1986). For example, Hammond (1994) demonstrates how the same raw data can be interpreted in different ways by M-form and U-form structures. Since the interpretation of raw data is different, decision-making would be different.

Some empirical works support the notion that structure affects strategy. For example, Miller (1987) investigated the relationship between three aspects of so-called ‘dominant’ structure (formalization, centralization, complexity) and three dimensions of strategy-making (rationality, assertiveness, interaction). Rationality dimension includes analysis, future orientation/planning, explicitness of strategy, and systematic scanning of environment; interaction dimension includes consensus building and bargaining in a decision-making process; and assertiveness dimension concerns proactiveness and risk-taking in decision-making. The results show that structural formalization is related to rationality and interaction dimensions and proactiveness aspects of assertiveness. Centralization was found to be related to planning, risk-taking, and consensus-building.

In a business-unit level analysis using the data on technology-intensive firms, Galbraith and Merrill (1991) explored the impact of compensation program and structure on SBU competitive strategy. One of the intriguing results with respect to structure is that delegation can be either positive or negative depending on the contents of decisions delegated. In the case of R&D-related decisions, delegations to lower levels help investment in R&D activities or capital equipment, whereas delegations of non-R&D-related decisions don’t. But centralization of non-R&D decisions helps control the level of technology/product quality.

In summary, organizational structure affects the way strategy is made both in the firm and business-unit levels. This is because organizational structure dictates the flow and interpretation of information and the way organizational participants interact with one another in the organization.

Organizational structure, business-unit strategy, performance

Based on the arguments of contingency theory, Hill and Hoskisson (1987) argue that different diversification strategies are related to different economic benefits. According to them, to realize economic benefits, a different diversification strategy should fit with appropriate organizational structure and control mechanisms. In other words structure moderates diversification strategy and firm performance. Hill, et al. (1992) tested the theoretical arguments proposed by Hill and Hoskisson (1987). Using data from 184 large firms, they found that firms pursuing economic benefits from scope economies (related diversification) perform better when their organizational structure and control mechanisms facilitate cooperation among business units, whereas firms geared to realize benefits from governance economies (unrelated diversification) better perform when their organizational arrangements stress competition among units.

Several scholars explored the implications of organizational structure and strategy on performance at business unit levels. On the relationship between decentralization and the effectiveness of strategic business units, Govindarajan (1986) proposed that, in order to enhance an SBU's effectiveness, the degree of decentralization of decision-making authority delegated to the general manager of the SBU should be closely aligned with the SBU's strategy. Specifically he proposes that when SBU's mission is 'build' (SBU is focused on gaining market share often at the expense of short-term profitability

and cash flow), decentralization leads to high SBU effectiveness, whereas the mission is 'harvest' (to maximize short-term profits and cash flow, often sacrificing market share), centralization leads to high SBU effectiveness. In addition to build-harvest continuum, he used Porter's (1980) differentiation-low cost strategy and Miles and Snow's (1978) prospector-defender typology to explore the relationship between centralization-decentralization and SBU effectiveness. He proposes that the combination of differentiation and prospect strategies and decentralization leads to high SBU effectiveness, whereas low cost and defender strategies with centralization lead to high SBU effectiveness.

Using the survey from the general managers of 58 SBUs of 8 firms, Gupta (1987) tested Govindarajan's (1986) arguments. Specifically, Gupta (1987) examined the moderating role of SBU's strategic contexts (strategic mission and competitive strategy) on the performance implications of three aspects of corporate-SBU relations. These three aspects are (1) openness in corporate-SBU relationship; (2) subjective assessment of SBU performance by corporate headquarters; and (3) corporate-SBU decentralization. The results show that SBUs pursuing differentiation strategy (low-cost) or market share (short-term profits), openness in corporate-SBU relationship and subjectivity in performance assessment were positively (negatively) associated with SBU effectiveness. In contrast, corporate-SBU decentralization was found to positively affect SBUs' effectiveness regardless of SBUs' strategic contexts.

The above study, however, did not differentiate the kinds of functions and activities that should be in the purview of the individual SBU (Golden, 1992). For example, prior research did focus on "decentralization" as a whole, but did not pay attention on SBUs' functions or activities that are the target of decentralization. Based on this criticism, Golden (1992) hypothesized that SBUs yield high performance when they control

the functions and activities most central to its strategy and avoid controlling peripheral functions or activities (e.g., SBUs with external strategic orientation control environmental monitoring activities and strategic decision analysis). The analysis from the survey administered to the hospital CEO and data including 496 SBUs supports the notion.

One of the important aspects of multibusiness firms is that business units in the same firm share resources with one another. Gupta and Govindarajan (1986) addressed the situation where resource sharing among SBUs is desirable and its implications. The results show that (1) the utility of resource sharing is a function of an SBU's competitive strategy (e.g., for SBUs pursuing low cost strategy, resource sharing is beneficial); (2) incentive systems for general managers of SBUs depend on the magnitude of resource sharing (e.g., the higher the resource sharing is, the better subjective evaluation is for performance); and (3) resource sharing has a negative effect on the job satisfaction of general managers partly due to the loss of control.

In summary, most of the relevant studies have not directly investigated how organizational structure affects firms' strategies or strategic behaviors. Regardless of the levels of analysis, they have either focused on the direct effect of organizational structure on performance, or investigating the moderating role of strategy on the relationship between organizational structure and performance from the perspective of contingency theory. Starting from the next chapter, we will address how organizational structure affects firms' strategic behavior in the context of product location choice.

CHAPTER III

THEORY AND HYPOTHESES

Introduction

In Chapter II I reviewed some of the existing literature on product differentiation and organizational structure. Despite its prevalence and importance as an outcome or means of firms' competitive actions in the product market, product location choice has not received sufficient attention from strategic management scholars. And research that explicitly explores the implication of a firm's structural arrangement on that firm's competitive outcome is rare. Based on this recognition, this study addresses product location choice from the perspective of the firms that have multidivisional (M-form) structure. As a way to link a firm's multidivisional structure to that firm's decision on product location choice, this study relies on the literature on M-form structure, status, product differentiation, competitive dynamics, and product cannibalization.

This chapter presents a theory and testable hypotheses for the study. To this end this chapter is organized as follows. First, this chapter starts with some basic notions about the M-form. Here the study addresses the rationale for the adoption of the M-form and divisional domains or charters. Regarding the adoption of the M-form, I address (1) Chandler's (1995[1962]) documentation on the basic characteristics of the M-form, Williamson's (1975, 1985) transaction cost approach to the M-form adoption and its critique; and (2) recent developments in IO economics on divisionalization and firms' product market competition, which provide some implications of M-form adoption on

product location choice. And based on the implications, a conceptual model of the study is presented.

Second, this study addresses the role of the status of a division on that division's product location choice. Each division is supposed to have its own status that is determined by each division's relative position in the economic, political, and prestige hierarchies among divisions in the same firm. Based on the sociological literature on status, this study argues that a higher-status division would garner more resources and have more discretion over its behaviors, which would lead the division to exhibit different behaviors in product location choice than lower-status divisions.

Third, this study explores the impact of divisional domain overlap between a focal division and rival divisions of competing firms (inter-firm divisional domain overlap) on the focal division's product location choice. Based on the arguments of niche overlap and competitive dynamics, this study argues that the magnitude of a focal division's domain overlap with a rival division, proportional to this focal division's own domain, would affect the focal division's product location choice. Specifically, the study suggests that a division with higher degree of domain overlap with a rival division, proportional to its own domain, would be more aggressive and consequently is more likely to locate its new products *closer* to that rival's products.

Fourth, this study deals with divisional domain overlap between a focal division and another division of the same firm (intra-firm divisional domain overlap) and its impact on the focal division's product location choice. Here I argue that firms have incentives to reduce the level of internal competition among divisions, and consequently divisions would work toward reducing internal competition when they introduce new products. Due to an asymmetric effect of divisional domain overlap, this study expects that a division with a higher level of intra-firm divisional domain overlap, proportional to its

own divisional domain, would have more incentives to locate its new product farther away from other divisions' products.

Divisionalization and New Product Location Choice

Analogous to firm's profit maximizing behavior, we could assume that a division tries to maximize its profits by selling its own products in the market. This would also be the case when it introduces a new product into the market. Profits from the new product could be broken down to four pieces according to their sources (cf. Traylor, 1986; Thomas and Weigelt, 2000).

Additional Profits from a New Product = Profits from market expansion + Profits taken from competitors' products + Profits taken from sister divisions' products + profits taken from its own division's products

First, profits from a new product could come from market expansion. By reaching beyond a current customer base through a new product introduction, a division could increase its profits. This could be the ideal situation for a division in the sense that it can increase its revenue or profits without aggravating its competitors. Second, a new product could contribute to a division by taking sales from competing products. A division may not necessarily expand market per se through a new product introduction, but it will definitely increase the revenue and profits. Third, a division's new product could take sales from the products offered by the division's sister divisions that belong to the same firm. In this case, the focal division's revenue and profits would increase, but unlike the previous two cases, firm profits may suffer. This portion of profits comes from inter-

divisional product cannibalization. And fourth, a division's new product could take sales from its own division's products. In this case, the focal division's own profits could suffer unless the new product yields more profits than cannibalized products. This portion of profits basically is due to intra-divisional product cannibalization.

The magnitude of the last three terms at the right-hand-side of the equation would be decided, at least in part, by the product features of a new product vis-à-vis competing products, the products of sister divisions, and the products of its own division. For example, low product differentiation with respect to rival products would surely increase competition, which would in turn increase the sales or profits at stake. And low product differentiation with respect to the products of sister divisions would increase the potential profits or revenues from inter-divisional cannibalization.

Here this study argues that a division's decision on the product features of its new product vis-à-vis competing products, the products of sister divisions, and its own products would be affected by the *division's structural relationships* vis-à-vis competing divisions and sister divisions as well as by the corporate headquarters. Competitive pressures from certain *structural relationships* with rival divisions or sister divisions could affect the focal division's new product location choice vis-à-vis these divisions' products. I argue that this phenomenon of structural relationships that the focal division has could be captured by the notion of *divisionalization*.

Divisionalization

Organizational structure refers to internal differentiation and patterns of relationships among major components (e.g., departments, divisions) of a complex organization (Thompson, 1967). In general, internal differentiation consists of vertical differentiation

and horizontal differentiation.³ From this perspective, divisionalization and subsequent multidivisional structure basically refers to the internal differentiation characterized with general office and divisions (vertical differentiation) and division(s) – division(s) (horizontal differentiation), and patterns of relationships among these major components. Thus this study addresses how divisionalization and consequent internal differentiation and patterns of relationships affect product location choice. As an initial step toward this end, let us start with the basic notion of division and divisional domain.

Division and divisional domain

A firm has its own domain that is characterized with (1) population (i.e., customers) served; (2) products and services rendered to the population; and (3) technology that is necessary in rendering products and services to the population (Thompson, 1967).

And a firm usually has multiple contingencies around its domain. Therefore firms seeking rationality “cluster capacities into self-sufficient units, each equipped with the full array of resources necessary for the organization to meet contingencies” (Thompson, 1967: 78). In this regard horizontal differentiation through divisionalization may be understood as an attempt for a firm to let its multiple divisions handle these multiple contingencies that the firm is faced with. As mentioned in Chapter I, here division refers to operating divisions, not supporting divisions such as human resources or finance.

Since each division is supposed to handle a part of the contingencies of the firm to which the division belongs, it should have its own domain that is in turn a portion of the firm’s domain. Divisional charter or domain is “the businesses (i.e., product and market arenas) in which a division actively participate and for which it is responsible within the corporation” (Galunic and Eisenhardt, 1996: 256). Since this study concerns

³ In addition to these two types of differentiation, Hall (1999) adds geographical dispersion.

product location choice that is about choosing the characteristics of a new product, it would better serve the purpose of the current study to define divisional domain using the notion of product characteristics. If we assume that all products can be sufficiently represented as combinations of different values of n common characteristics, then we can locate a product as a point in an n -dimensional product characteristics space. And if a division offers k products, then we can locate the products of this division by k points in an n -dimensional space. Thus when a division offers k products that are combinations of different values of n common characteristics, the divisional domain of this division could be defined as the multidimensional area inside k points in an n -dimensional product characteristics space. Depending upon the contingencies that a division is supposed to handle, the domain of the division could change over time through charter gains or losses (Galunic and Eisenhardt, 1996, 2000).⁴

If we assume that we can represent the characteristics of a product as a scalar value on one-dimensional space, divisional domains could be depicted as shown in Figure 3.1 (See Appendix A). This figure depicts the divisional charters of GM and Ford Motor Co. in 1992. The product market is split on the basis of market segment (from left, lower small car, middle small car, . . . , luxury sport car) and the size shaded areas of each division along the product characteristics space represent each division's magnitude of presence in the corresponding market segments. So the area that each division occupies represents its divisional domain and for which it is responsible within the firm.

In the above, the study mainly has focused on divisionalization based on the product market. In addition to this product-based divisionalization, the firm could divi-

⁴ Divisional domain can be defined based on other criteria. A case in point is GM when it reorganized itself in the early 1920s. GM defined divisional boundaries on the basis of price so that each division has its own price range (domain or charter) and ideally one division's price range would not overlap with those of other divisions: Cadillac sold in the highest-priced position, Buick the next, then Oakland, and then Olds, and finally Chevrolet in the lowest-priced market (Chandler, 1995[1962]).

sionalize on the basis of customers or geographic regions. With respect to customer-based divisionalization, the firm might have two divisions: one covers individual customers whereas the other serves business customers. This customer-based divisionalization could be equally depicted by a kind of figure introduced just before. This time the dimension should be customer segment, not segments based on product characteristics. In this case the overlap could be easily observed in the area where individual customers and business customers meet. Generally small-sized businesses could operate using equipment or services that are originally tuned for individual customers (e.g., computer industry). But the current notion of product-based divisional domain may not fully accommodate the case where the firm divisionalizes on the basis of geographic regions and each region-based division covers a full range of products offered by the firm.

Divisional domain and product location choice

With respect to divisional domain, a division could have three options in locating its new product. First, a division could locate its new product either close to or far away from its current products or divisional domain. The closer the location of a new product, the division could better exploit its existing capabilities but the chances of cannibalizing its own products would increase, whereas the farther away the location, the division needs more resources but the chances of cannibalization (i.e., intra-divisional cannibalization) would decrease. Second, a division could locate its new product either close to or far away from the divisional domains other divisions of the same firm. The closer (or farther) the location, the chances of inter-divisional cannibalization would increase (or decrease). And third, a division could locate its new product either close to or far away from the divisional domains of rival divisions. The closer (or farther) the location to rival divisions' domains, the competition between the focal division and rival divisions would

increase (or decrease). Thus, the location choice of a new product by a focal division could be influenced by factors idiosyncratic to the focal division, factors on the relationship between a focal division and other divisions of the same firm, and factors relevant to the relationship between a focal division and its rival divisions in the product market. In this regard, prior studies on divisionalization provide some implications.

General office and divisions

In addition to divisional domains or charters, another peculiar characteristic of multidivisional structure is the existence of general office and its role. General office was created from the need to alleviate the administrative load on executive officers. In this respect, Chandler (1995[1962]) argue that M-form structure is a creative innovation to handle the situation when the administrative load on executive officers reached to such an extent that they could not execute their entrepreneurial responsibilities efficiently. According to him, the success of multidivisional structure resides in the separation between entrepreneurial actions/decisions and operating actions/decisions, and states the different roles between top team generalists and division managers as follow (Chandler, 1995[1962], 309-311).

The basic reason for its success was simply that it clearly removed the executives responsible for the destiny of the entire enterprise from the more routine operational activities and so gave them the time, information, and even psychological commitment for long-term planning and appraisal. ... Thus the new structure left the broad strategic decisions as to the allocation of existing resources and the acquisition of new ones in the hands of a *top team generalists*. ... In this way, the new structure left the divisional executives to run the business, while the general officers set the goals and policies and provided over-all appraisal. *The division managers*, responsible for the functional activities of their units, made decisions about prices charged on specific products, about design and quality of the existing products and the development of new ones, about more immediate markets and marketing, about probable resources of supply, about

technological improvements, and finally about the flow of product from supplier to consumer. But these decisions were to be made within the framework set by the broad policy guides and financial budgets through which the general executives determined the present and future allocation of resources of the enterprise as a whole and within the carefully defined interrelationships between the operating units and the general office as indicated by the company's structure. (*Italics added*)

Extended from Chandler (1995[1962]), Williamson (1975, 1985) focuses on the transaction cost minimizing properties of the M-form, which became possible due to the separation of two distinctive roles mentioned above. He presents a succinct summary of the role of general office under optimum divisionalization. According to him, the function of the general office under optimum divisionalization (i.e., under so-called 'pure' M-form structure) involves: (1) the identification of separable economic activities within the firm; (2) according quasi-autonomous standing (usually of a profit center nature) to each; (3) monitoring the efficiency performance of each division; (4) awarding incentives; (5) allocating cash flows to high-yield uses; and (6) performing strategic planning (diversification, acquisition, divestiture, and related activities) in other respects (Williamson, 1975: 149). In sum, what is innovative of the M-form is that general executives are relieved from operational actions and decisions, and focus on two major roles: strategic planning and resource allocation, and monitoring divisional performance using a control apparatus, which ultimately leads to minimize transaction costs.

Focusing on two main roles of general executives of the M-form, Williamson (1975, 1985) further argues that the M-form provides a frictionless miniature capital market inside the firm. An external capital market easily fails to work due to information asymmetry and lack of an effective control apparatus on the part of investors. But, within the M-form, general executives play the role of profit-maximizing investors, and unlike external investors, they are not disadvantaged in terms of information asymmetry

and have a control apparatus at hand to discipline division managers. Thus M-form has the transaction cost minimizing properties, which is why the M-form is superior to the U-form (M-Form Hypothesis).

The Williamsonian approach to the M-form, represented by M-form hypothesis, however, is not without critiques. A thorough critique was provided by Hill (1985). He criticizes this theory on three grounds: (1) the assumption of external capital market failure may not hold any more due to the increased efficiency of an external capital market; (2) general executives do not necessarily act as profit-maximizing investors, which is what agency theory posits; and (3) an M-form control apparatus may trigger potentially serious problems such as risk-aversion and short-run profit-maximizing behavior on the part of division managers.⁵

Pure multidivisional structure (M-form) could be further broken into two sub-categories: type D₁ that is a highly integrated M-form enterprise offering differentiated but otherwise common final products; and type D₂ that offers diversified final products or services.⁶ Here we are concerned with type D₁. This type of M-form needs a more extensive control apparatus to manage spillover effects.

Regarding resource allocation, the above approach to divisionalization and consequent adoption multidivisional structure (Chandler, 1995[1962]; Williamson, 1975, 1985) begs a question: Would general office allocate resources to its divisions solely based on objective performance data of each division? Ideally general office in the mul-

⁵ For more detailed documentation on the critiques about Williamson's (1975, 1985) conception of the M-form, readers are referred to Hoskisson, Hill, and Kim (1993).

⁶ In addition to pure M-form, Williamson (1975) presents two other M-form structures: transitional multidivisional (M'-form) and corrupted multidivisional (\bar{M} -form). Transitional multidivisional is the M-form enterprise that is in the process of adjustment toward pure M-form. And corrupted multidivisional is a multidivisional structure in which a control apparatus is provided but general executives are extensively involved in divisions' operating affairs. In sum, M-form structure itself is not one dimensional and has several variants.

divisional structure should be able to allocate resources to each division depending on each division's potential for future performance. Prior studies, however, argued that when corporate headquarters allocate resources to a division, they don't do this solely on the basis of its potential for future performance, but rather on the basis of prior performances or a division's significance in the firm (Simon, 1997; Cyert and March, 1963). This is partly because of bounded rationality of corporate headquarters due to an uncertain external environment, and difficulties in perfectly measuring divisional performances which may be more complicated with spillover effects between divisions.

With respect to resource allocation contingent upon structural arrangement of the firm, Bower (1970) provides another insight. He argues that organizational structure influences definition and impetus processes of investment as well as business planning process. In other words, structural context affects the pressure from the inside by dictating the way a project is defined and pushed upward for resources and support. Thus structural shift can influence how an investment opportunity is conceived at the division and corporate levels (Bower, 1970: 296).

Structure can be changed to change the way in which *opportunity* is perceived and projects evaluated. In addition, *structural shifts* can be used to broaden the concept of the opportunity for useful influence among managers at the division and process levels of the company. (Italics added)

Thus, we can expect that there may be room that a division can influence resource allocation for its favor. Here the study argues that divisional status would play a role in resource allocation. The literature on status suggests that status matters partly because it is a signal or information that reduces the uncertainty involved in market transactions (e.g., Podolny, 1993, 1994; Benjamin and Podolny, 1999), interorganizational relations (Chung, Singh, and Lee, 2000) or technology diffusion (Podolny and Stuart,

1995), or allocating grants (Pfeffer, Salancik, and Leblebci, 1976). And because of the uncertainty-reducing property of status, higher-status holders earn more resources from customers and consequently more profits, form more alliances with higher-status partners, or garner more grants than lower-status holders. This suggests that a higher-status division would be more likely to receive favorable treatment from corporate headquarters and garner more resources than lower-status divisions in the same firm. And more resources would allow the higher-status division to experiment with new products with improved features or quality (cf. Schumpeter, 1934), which further indicates that higher-status divisions would exhibit different behaviors in product location choice than lower-status divisions. This is the first issue that I will address later regarding divisions' product location choices.

Multiple divisions and competition in the product market

Up to now I have addressed the adoption of the M-form from the perspective of the separation between general executives' entrepreneurial actions/decisions and division managers' operating actions/decisions (Chandler, 1995[1962]), and consequent transaction cost minimizing properties of the M-form (Williamson, 1975, 1985), which ultimately makes the M-form efficient. In addition to this, some of the IO economics scholars have addressed why divisionalization is more profitable than remaining as a unified whole from the perspective of competition in the product markets (e.g., Corchon, 1991; Schwartz and Thompson, 1986; Veendorp, 1991; Polasky, 1992; Baye, Crocker, and Ju, 1996a, 1996b). Basically they argue that through divisionalization firms can either deter entry or achieve Stackelberg leadership in the product market, which may ultimately makes divisionalization more profitable than operating as a unified whole.

First, firms have incentives to deter entry through divisionalization. In an oligopoly market, incumbent firms set up new divisions to preempt entry (Schwartz and Thompson, 1986). According to them, divisionalization for preemption always dominates noninnovative entry, which ensures that incumbents in oligopolistic industries forestall all entry by noninnovative potential entrants. This is because independent and competing divisions would perfectly emulate the behaviors of potential entrants and thereby forestall a noninnovative entrant.⁷ Extended from Schwartz and Thompson (1986), Veendorp (1991) argues that creating sufficient numbers of independent divisions or operating centers can deter entry. And with respect to the potential negative impact of the divisions' independent actions (e.g., competing against each other) on overall firm profitability, Veendorp (1991) contends that prior investment in division-specific capital can limit the negative impact.

Second, through divisionalization, firms can achieve Stackelberg leadership in the product market. Corchon (1991) argues that large firms have incentives to create several independent divisions that compete in the same market as a credible commitment to Stackelberg leadership of the firms. Baye, et al. (1996b) demonstrate that, in a two-stage game, setting up autonomous competing units (stage one) that behave independent from profit maximizers allows a parent firm to commit unilaterally to a greater level of output (stage two), thereby mimicking a Stackelberg-type outcome in the product market. Therefore, oligopolistic producers have the unilateral incentive to divisionalize and increase firm profits. In a similar two-stage model, Polasky (1992) argues that it is more profitable for the firm to form (completely) independent competing divisions rather than

⁷ Schwartz and Thompson (1986) argue that entry-forestalling divisionalization would occur in exceptionally profitable, oligopolistic industries. They also provide some examples: GM's reorganization in the early 1970s due to low profits after the entry of Japanese car makers; Seagram's recentralization in the 1980s due to low demand and low threat of entry; and P&G's divisionalization due to high profits.

to remain as a unified whole, because independent divisions will act independently to each other, which will result in making the firm more aggressive and induce rival firms to be less aggressive when output decisions are made (in stage two). In sum, forming independent rival divisions is more profitable than remaining as a unified whole because divisionalization allows the divisionalized firm to deter entry and to achieve Stackelberg leadership.

Then should this kind of divisionalization be the prescription for every multiproduct firm? Here the study presents two considerations that should be included in answering this question: (1) the formation of rival divisions by competing firms; and (2) interdependencies among divisions of the same firm. First, we should consider the situation where a focal firm with multidivisional structure competes with other firms that also have multiple divisions. The IO economics literature on divisionalization assumes that a focal firm faces with single-division competitors. However, this is rather an exception. For example, major players in computer manufacturing industry such as Dell and HP have multiple divisions that cover different types of products (e.g., products for businesses or consumers) or geographical regions. In this respect, Polasky (1992) argues that the results may not hold when firms in an industry form multiple divisions and compete against each other using their respective divisions. This poses a problem in *directly* applying the arguments of the current literature to divisions' product location choices. We need to incorporate the reality that both a focal firm and competing firms have multiple divisions.

Here the study argues that we need to pay attention to the way a focal firm positions its divisions along the product markets vis-à-vis its competing firms. As shown in Figure 3.1, two competing firms could split the same product market differently in terms of the number of divisions or divisional domains. Each division has its own divisional

domain; and confronts with different sets of rival divisions of competing firms, depending on the location of its domain along the product market. Note that this study is concerned with an industry offering differentiated products, and consequently, cross-elasticity between products decreases as the distance between products increases (Gabszewicz, 1999; Schmalensee, 1978, 1985). This suggests that rival divisions that a focal division actively competes with should be those whose divisional domains overlap with that of the focal division. The literature on organizational ecology (e.g., Hannan and Freeman, 1989; Podolny and Stuart, 1995; McPherson, 1983) and competitive dynamics (e.g., Chen, 1996; Baum and Korn, 1996) suggests that the same amount of absolute niche overlap or market domain overlap between two competitors poses an asymmetric competitive threat to them depending on the importance of the overlapped portion to each firm. Thus, this study expects that the degree of divisional overlap between a focal division and rival divisions would matter when it chooses the location of its new product. Specifically this study predicts that the higher the degree of divisional domain overlap between a focal division and its rival divisions (relative to the focal division's domain), the focal division will be more aggressive, which will be reflected in the focal division's product location choice of its new product.

Second, we should also take into account the internal relationship among divisions of the same firm when we look into divisions' competitive activities including product location choices. Most IO studies on divisionalization have assumed that independent divisions compete with one another as much as they compete with other firms. And we may say that the mechanism that has driven many of these models of divisionalization in IO economics is the strategic effect of inter-divisional cannibalization by which the divisionalized firm becomes more aggressive (consequently rival firms become less aggressive at the 2nd stage according to a 2-stage game) and be able to deter

entry. However, the flip side of this driving mechanism of divisionalization is that the tendency to avoid inter-divisional cannibalization may make firms and consequently their divisions less likely to be competitively aggressive against one another. Some recent studies on divisionalization in IO economics point out the tendency to avoid cannibalization.

Some recent IO studies on divisionalization suggest that divisions do not necessarily engage in intense competition with other divisions of the same firm when there is the possibility that firms renegotiate unobservable contracts with their divisions (Hadfield, 1991; Corts and Neher, 1999). In a similar context, Corts (2001) found that the multiple divisions of a studio act more like an integrated firm in that they schedule the films that are jointly distributed and produced by other divisions of the same studio more efficiently than the films from purely competing divisions of other studios. And general office has the means to influence the behaviors of divisions so that overall organizational performance could increase. For example, corporate headquarters could facilitate cooperation among divisions by using appropriate incentives (Hill, et al., 1992).

Thus, it is very hard to expect that divisions of the same firm would be allowed to compete with each other, at least, as intensively as they do against rival divisions. This study further expects that a focal division would try not to pose a competitive threat to other divisions of the same firm voluntarily or pressured by corporate headquarters. Here a competitive threat that a focal division poses to another division of the same firm is conceptualized as the divisional domain overlap between the focal division and the other one. And the study also expects that competitive asymmetry will hold. Specifically, this study predicts that a division with a higher degree of divisional overlap (i.e., overlapped portion means more to this division than the other one) would be feel more

competitive pressure from this overlap, and try to alleviate the pressure by decreasing the overlap, which would be reflected in the division's new product location choice.

A conceptual model for the study

Figure 3.2 presents a conceptual model for the study. The model depicts the effects of divisionalization on product location choice from a division's perspective. As shown in the figure, this study focuses on three aspects of divisionalization that were presented in the previous section: the status of a division, inter-firm divisional domain overlap, and intra-firm divisional domain overlap (See Appendix A).

The conceptual model depicts that the status of a division influences the distance between a new product of a division and this division's existing products. And industry-wide uncertainty moderates the relationship between divisional status and product location choice. Second, the model shows that a focal division's inter-firm divisional domain overlap (i.e., divisional domain overlap between a focal division and a rival division) would affect how closely the focal division locates its new product vis-à-vis the products of a rival division. And this posited relationship would vary depending on how crowded the focal division's domain is. Third, the model suggests that a focal division's intra-firm divisional domain overlap (i.e., divisional domain overlap between a focal division and another division of the same firm) has an impact on how closely or farther way the focal division locates its new product vis-à-vis the products of the overlap division of the same firm. In addition, the model specifies several other moderating effects. From now on I present the hypotheses.

Divisional Status and New Product Location Choice

Before addressing divisional status, let us talk about the status of an individual and then the status a firm. The *status* of an individual refers to the relative position that the individual occupies within a hierarchy (Benoit-Smullyan, 1944).⁸ Benoit-Smullyan (1944) suggests three chief hierarchies that are fundamental in defining the status of an individual: the economic hierarchy, the political hierarchy, and the prestige hierarchy. Thus, an individual's relative position within these three hierarchies constitutes her economic status, political status, and prestige status. These three forms of status are correlated with one another in that they reinforce one another, but at the same time each one is distinct from one another. These three forms of status of an individual as whole constitute the *social status* of that individual.

At the organizational level Podolny (1993) provides another definition of status in his status-based model of market competition. In the context of market, he defines a producer's status as "the perceived quality of that producer's products in relation to the perceived quality of that producer's competitors' products" (Podolny, 1993: 830). This status-based model of market competition suggests that a producer's status mainly comes from two sources: a producer's past demonstrations of good quality and the status of its exchange partners (Podolny, 1993, 1994; Podolny and Stuart, 1995; Benjamin and Podolny, 1999; Stuart, Hoang, and Hybels, 1999). The former source is similar to what an economics model of reputation has argued: past quality is an important source of in-

⁸ Related to the definition of status, Benoit-Smullyan (1944: 151) defines hierarchy and hierarchical position as follows: "By a hierarchy we mean a number of individuals ordered on an inferiority-superiority scale with respect to the comparative degree to which they possess or embody some socially approved or generally desired attribute or characteristic. A hierarchical position is always a position in which one individual is identified with others with regard to the possession or embodiment of some common characteristic, but differentiated from these others in the *degree*, or *measure*, to which that characteristic is possessed or embodied." (Italics are original)

formation (i.e., signal) about the current quality of a product (Shapiro, 1983). What is distinctive about this is the second source that emphasizes the role of affiliations (or ties) of actors in a network of relations.

Analogous to Benoit-Smullyan (1944), the *status of a division* or divisional status is defined as the relative position of that division in a firm with respect to economic, political, and prestige hierarchies. Here hierarchies are defined among the divisions of the same firm. Then where does economic status come from? Sociological literature suggests that one of the sources for an individual is her income level relative to other people in the community (Weber, 1968; Benoit-Smullyan, 1944). This may suggest that a division's economic status comes from its past economic performance and contribution to firm performance. And a division's political status may come from the division's relationship with corporate executives who are responsible for resource allocation and investment approval, such as a CEO or a board of directors. And prestigious status may come from the quality of products (e.g., Cadillac Division).

Status matters because it affects a status holder's behavior. Prior studies on status provide ample evidence at the individual, group, and organizational levels. At the individual level, studies show that status determines evaluations of and performance-expectations for group members, and hence the distribution of participation, influence, and prestige at a later stage (Berger, Cohen, and Zelditch, 1972); higher-status subjects (teachers) claim more space with their bodies, talked more, attempted more interruptions, and more frequently intruded upon their partners than lower-status subjects (students) (Leffler, Gillespie, and Conaty, 1982); and initial status differences make different influence patterns at a later stage regardless of their relevance on the task at hand (Moore, 1968, 1969). At the group level, Manheim (1960) demonstrated that the status differences between two groups are positively related to the level of conflicts between

them. And at the organizational level, an organization's own status has a positive impact on market outcomes such as life chances of organizations (Podolny, Stuart, and Hannan, 1996); the spread between costs and price in the investment banking industry (Podolny, 1993); influence over the direction of technological innovation in the semiconductor industry (Podolny and Stuart, 1995); the reactions of the financial community with respect to initial public offerings (Stuart, Hoang, and Hybels, 1999); choice on product quality and the returns from producing a given quality in the California wine industry (Benjamin and Podolny, 1999). And studies also show that firms with similar status are more likely to form alliances in the U.S. investment banking industry (Chung, et al., 2000) and engage in transactions in investment banking (Podolny, 1994).

So we expect that the status of a division may also affect the division's behavior including its product location choice. Status matters in transactions in the market because status reduces the uncertainty about the quality of products or services (Podolny, 1993, 1994; Benjamin and Podolny, 1999) or the prospect of new technology (Podolny and Stuart, 1995). If firms or consumers are certain about quality or the outcome of new technological innovation, they would not rely on status as a means to minimize uncertainty (cf. Podolny, 1993). Here I argue that the status of a division matters primarily because the status of a division reduces the uncertainty involved in resource allocation on the hand of corporate headquarters.

One of the primary characteristics of multidivisional structure is that corporate headquarters allocate or reallocate resources to high-yield uses (Chandler, 1995[1962]; Williamson, 1975, 1985). However, it is very hard to figure out the presumed performance of a certain investment project or proposal by divisions (Walton, 1997; Cyert and March, 1992). Here is why the resource allocation among subunits such as divisions is "quite sensitive to past experience, to the experience of comparable subunits, and to the

prima facie relevance of the subunit to other parts of the organization” (Cyert and March, 1992: 184). In the case of project funding, firms allocate resources on the basis of historical legitimacy, current organizational emphasis, and presumed performance (Cyert and March, 1992). Thus we expect that firms may be more likely to allocate resources primarily to divisions that have shown good economic performance in the past and consequently have higher economic status and prestige status. In other words, allocating resources to a higher status division would be a more credible investment than to a lower status division.

In addition to economic status, the political status of a division would also help a higher status division secure more resources than a lower status division. Status is one of the sources of power (Weber, 1968), and political status especially is closely related to power (Benoit-Smullyan, 1944). With respect to power, resource dependence theory also suggests that when an organization provides resources to other organizations for resources, the organization exercises power over those organizations (Pfeffer and Salancik, 1978). A division with high economic status would bring in resources (e.g., cash flows) that may be reallocated to other divisions by corporate headquarters. So we may expect that the division may exercise power over other divisions.

With respect to resource allocation among subunits, politics and power play an important role (Cyert and March, 1992; Simon, 1997; Bower, 1970) because of the conflicting interests of the subunits and the scarcity of resources. Arrow (1974) argues that when subunits have the same information but different interests over the information, the conflicts among the subunits could be solved by bargaining among involved parties. Thus we can expect the conflicts would be solved in favor a subunit with higher bargaining power over other subunits involved. This suggests that when a new investment opportunity emerges and several divisions vie for the opportunity and necessary resources,

a higher status division is more likely to win over the contest for resource allocation, if other things be equal.

More resources may allow a higher status division to experiment with new products that are quite different from their current product lines in terms of product features or product quality. But for a lower status division that is at a disadvantage in securing resources, the chances of investing in a new product that is quite different from their current product lines would be very low. So it may be more likely to focus on maintaining its current product lines. In sum, higher status divisions can have means to develop products that are different from their current product lines compared with lower status divisions.

In addition, a higher status division also has incentives to keep up its in terms of quality or variety of product features. Prior studies show that firms have incentives not to lower the quality of their products that may harm their status in the market (Benjamin and Podolny, 1999; Podolny, 1993). And Christensen (1997) demonstrates that firms that have pioneered in developing new products are more interested in constantly enhancing the performance of their products by focusing on developing technology that is sustaining in nature. This may suggest that a higher status division is motivated to enhance its status by enhancing its products.

In sum, higher-status divisions are more likely to have credibility in terms of successful investment from corporate headquarters, have power to prevail over other divisions in the case of conflicting interests among them, and motivation to develop new products that are better than previous products and would sustain their current status. These arguments lead to the following hypothesis.

Hypothesis 1. The *higher* the status of a division is, the *greater* the distance between that division's new product and its existing products.

It was mentioned that status matters in market transaction, technology adoption, or alliance formations, because it reduces uncertainty inherent in these actions (e.g., Podolny, 1993, 1994; Podolny and Stuart, 1995; Chung, et al., 2000). In a similar vein, Pfeffer, et al. (1976) also showed that when uncertainty is high (i.e., lack of dominant paradigm in an academic discipline), people are more likely to use particularistic criteria such as *social influence* rather than universal ones in allocating awards (i.e., grants). So this study also expects that, under high levels of uncertainty, corporate headquarters are more likely to allocate resources to a higher status division, which would make the relationship between the status of a division and the division's product location choice more pronounced.

Uncertainty could involve many different forms depending on the context in question: the quality of investment banking service (Podolny, 1993), the quality of the product (Podolny, 1994), quality of the technology (Podolny and Stuart, 1995), or the lack of a dominant paradigm (Pfeffer, et al., 1976). With respect to allocation of resources on the part of corporate headquarters, the uncertainty about the outcome of any resource allocation will be high when the competition in the market is high, thus the results of investment at the hands of corporate headquarters are highly uncertain. This idea leads to the second hypothesis.

Hypothesis 2. The *higher* the level of competitive uncertainty, the predicted relationship between the status of a division and that division's product location choice [i.e., the *higher* the status of a division, the *greater* the distance between that division's new product and its own existing products.] will be *stronger*.

Inter-firm Divisional Domain Overlap and New Product Location Choice

In the above I have argued that a higher status division is more likely to launch its new product farther way from its existing product lines than lower status division; and this relationship will be more pronounced when the level of uncertainty felt by a firm is high. Then, how about new product location vis-à-vis rival products? Here comes the role of a division's inter-firm divisional overlap with rival divisions. As shown in Figure 3.1, each division has its own divisional domain and is faced with rival divisions of competing firms. Here rival divisions of a focal division refer to divisions whose divisional domains overlap with the focal division's domain. I argue that the degree of a division's inter-firm divisional overlap with a rival division would affect the way the focal division chooses the location of its new product vis-à-vis that rival division.

The literature on competition from organizational ecology, economics, and strategic management suggests that the degree domain overlap between a focal firm and competing firms is positively related to the intensity of competition the focal firm experiences (Hannan and Freeman, 1977, 1989; Scherer and Ross, 1990; Tirole, 1988; Porter, 1980; Baum and Korn, 1996). This is because firms targeting similar markets have similar resource requirements, which increases the potential for competition among them seeking the same resources. Here resources can refer to customers, organizational members, or clients (e.g., Hannan and Freeman, 1989). In other words, as the breadth of markets between two firms increases, the potential for competition increases.

The increase of the breadth of markets, however, does not necessarily lead to an increase in the intensity of competition (Baum and Korn, 1996). Even though the breadth of overlapped market increases, the intensity of competition may not increase proportionately because the competition may be diffused over a greater scope of markets and

the need for mutual forbearance may also increase (cf. Edwards, 1955; Gimeno and Woo, 1996; Baum and Korn, 1996). But in a differentiated industry that the current study is concerned with, mutual forbearance may not hold. Mutual forbearance works well when market boundaries are well defined (Singal, 1996) and, in the case of a differentiated market, firms should successfully cartelize at least one of the product markets in isolation so that firms can cross-subsidy other markets using slacking from this successfully isolated market (Bernheim and Whinston, 1990). Thus, if an industry with differentiated products is characterized with products that are closely related to one another through a series of chains of demands, i.e., high cross-elasticity among adjacent products and low potential for isolating one particular product market, mutual forbearance may not work well.

Prior empirical studies from this perspective have validated this logic. Studies found that hotels that are similar with respect to size, geographic location, and price are more likely to compete against one another (Baum and Mezias, 1992); day care centers that are similar in terms of the ages of target children and geographic location compete more intensely with one another (Baum and Singh, 1994a, 1994b); the competition between two voluntary organizations is proportional to the similarity of their memberships in terms of sociodemographic characteristics (i.e., the degree of niche overlap) (McPherson, 1983); and the degree of niche overlap has a negative impact on organizations' life chances due to increased competition among firms in the niche (Podolny, Stuart, and Hannan, 1996).

The argument of divisional charter or domain (Galunic and Eisenhardt, 1996, 2000) or organizational domain (Thompson, 1967) also suggests that the resource requirements of a focal division are quite similar with those of rival divisions (of competing firms) that cover similar domains or charters. So the level of competition between

two rival divisions would be proportional to the degree of divisional overlap between the two. However, a given level of divisional overlap would pose a different threat or competitive pressure to the divisions concerned due to the asymmetric nature of domain overlap.

Competitive asymmetry occurs because the same absolute amount of overlap can be interpreted differently depending on a firm's overall domain (Chen, 1996; Podolny, et al., 1996; McPherson, 1983). For example, let's assume a focal firm occupies an area of 50 and its rival firm 100, and the domain overlap between the two firms is 20. For the focal firm the overlapped portion with its rival firm is 40% of its domain, whereas for the rival firm it is 20%. Thus the focal firm should feel more competitive pressure than the rival firm. And it is not surprising that the focal firm would regard the rival firm more seriously than the rival firm does. In this regard Chen (1996: 117-118) suggests that:

Firms that are considered nonkey competitors may be granted a wide latitude of action without provoking retaliation from their stronger counterparts. Similarly, stronger rivals may not be aware of the threat from weaker opponents, which view such powerful firms as their main targets. Such weaker firms may go unrealized or disregarded despite the damage they may inflict.

So what matters is not as much as overlap itself between rivals as the meaning or significance of the overlap to the rivals concerned. I believe that this logic would also hold for divisions and divisional overlap between rival divisions. A focal division with high level of domain overlap with a rival division *proportional to its own domain* would feel a more competitive threat than the rival division does, which may encourage the focal division to be more aggressive toward the rival division. This suggests that a division with a higher level of domain overlap (proportional to its own domain) would be more

aggressive or competitive in locating their new products than the one with a low level domain overlap with a rival division. In sum, a division with a high degree of inter-firm divisional domain overlap has more incentives to launch a competitive attack against the rival division.

Then, where does the focal division launch its new product? This study argues that we can find a clue in the argument of mimicry: firms are more likely to imitate or take seriously direct competing firms in their strategic actions. Firms observe one another's actions, then determine who are their major rivals, and then based on this observation define unique product positions in relation to one another (Porac, Thomas, Wilson, Paton, and Kanfer, 1995). From the perspective of multimarket contact among competing firms, Greve (1995, 1996) also found that radio stations would be more likely to adopt the format of their multimarket competitors. These studies suggest that mimetic strategic actions between firms may increase as their market overlap increases. This provides a clue how a focal division position its new product in relation to its divisional domain overlap with rival divisions of competing firms: the focal division may imitate the product positions of its rival division with whom it has high level of divisional overlap.

And the notion of product cannibalization, in this case intra-divisional cannibalization, suggests that a focal division has incentives to avoid inadvertently cannibalizing its own products (cf. Copulsky, 1976). Thus a focal division is more likely to locate its new product in such a location where the chances of intra-divisional cannibalization could be minimized. The location may be outside the range of the focal division's divisional domain. In this way the focal division may pursue competitive parity with rival divisions, which might decrease the level of competition (cf. Baum and Korn, 1996) Thus, the following hypothesis is tested.

Hypothesis 3. The *higher* the degree of a focal division's inter-firm divisional overlap with a rival division, proportional to the focal division's divisional domain, the *closer* the distance between the focal division's *new* product and the rival division's existing products.

A division's decision to locate its new product closer to rival divisions' products suggests that over time a division with a higher degree of divisional overlap with rival divisions of competing firm may expand its divisional domain. Through a series of mimetic processes in product location choice, the divisional structure or charters of competing firms would look more or less alike. And this may further lead to a long-term consistency between the organizational structures of competing firms.

In addition to the degree of a focal division's inter-firm divisional overlap, the density of a division would play an important role in explaining the division's new product location choice. Here the *density* of a division refers to how crowded the division's domain is. Thus, higher density means that the products offered by a division are closely located to one another, which increases chances of intra-division cannibalization. So the tendency to avoid intra-divisional cannibalization will affect a division's new product location choice vis-à-vis rival products.

The literature on horizontal product differentiation suggests that unlike the case of homogeneous goods, an industry with differentiated goods is characterized with localized competition (Schmalensee, 1978, 1985; Eaton and Lipsey, 1979, 1989; Judd, 1985). The basic idea of localized competition is that a product does not compete directly with all the products in the market, but with a small number of products that are close to the product. In a one-dimensional product characteristic space, a product has at most two directly competing products that surround it (Schmalensee, 1978). And the products that

are located next to these two directly competing products become indirectly competing products (Gabszewicz and Thisse, 1986b). For example, when there are products A, B, C, D, and E from left to right in a one-dimensional product characteristic space, the directly competing products of product B are products A and C, whereas product D is an indirectly competing products. Consequently the intensity of competition for product B mainly revolves around products A and C. The competition between products B and D is mediated by product C. In other words the cross-elasticity between product B and products A and C is higher than that between product B and product D. Therefore a new product does not compete directly with all the products in the market, but with only those who are located close to it on the product space. Eaton and Lipsey (1989: 750) provide a succinct summary about this localized competition in an industry with differentiated products.

But in address models, the location of existing goods or products balkanizes the market into a number of overlapping submarkets. As a result, competition is localized – each good has only a few neighboring goods with which it competes directly, regardless of the number of goods serving the entire market.

One of the immediate consequences of high level of density, or close located products by a division is that this may increase the chances of intra-division product cannibalization. This further implies that when the density of a focal division is higher than that of rival divisions, the chances of intra-divisional product cannibalization increases when the focal division attempts to locate its new product distant from the products of rival divisions. The worst case would be when a focal division locates its new product between its own existing products in product characteristics space, and the chances of this worst scenario may increase as the density of the focal division is higher

than that of rival divisions. In this case, new revenue streams from new product introduction would come solely from cannibalized sales, rather than either from market expansion or from rival divisions' sales. So when the density of a focal division is high, this division has incentives to locate its new product closer to rival products and in so doing decrease the chances of intra-divisional product cannibalization.

This expectation would also hold for vertical differentiation. The primary reason of a firm to locate its products far away from rival products is to relax price competition that might occur due to close location to rival products (e.g., Shaked and Sutton, 1982). This idea also suggests that a division has incentives to locate its new products distant from its current products to relax any potential intra-division product cannibalization. So when the density of a focal division is high, we expect that the loss due to locating its new product closer to its existing products (i.e., loss due to intra-divisional cannibalization) may exceed the loss due to locating its new product closer to the products of rival divisions (i.e., loss due to intensified competition). This idea leads to the following hypothesis.

Hypothesis 4. The *higher* the density of a focal division's divisional domain is, the predicted relationship between the degree of the focal division's inter-firm divisional domain overlap and product location choice (i.e., the *higher* the degree of a focal division's inter-firm divisional overlap with a rival division, proportional to the focal division's domain, the *closer* the distance between the focal division's new product and the rival division's existing products) will be *stronger*.

Intra-firm Divisional Domain Overlap and New Product Location Choice

Intra-firm divisional domain overlap indicates that there exists internal competition among divisions of the same firm vying for the same customers. Internal competi-

tion could help the firm, or at least be tolerated, depending on the intensity of competition and the context of competition. R&D competition between distinct development teams may reduce the development time (Kim, 1997; Gold, 1987); to survive disruptive innovations, firms should set up an small and autonomous organization equipped with disruptive innovations and let the organization compete against a parent company that pursues innovations based on sustaining technology (Christensen, 1997); or a reasonable level of internal competition is good for the firm (Mintzberg, 1991). Another study shows that internal competition among subgroups in a package delivery company improved quality control, a feature that is critical to company success (Kortick and O'Brien, 1996), whereas there is a report that internal competition creates quality problems (Posner, 1989).

Some firms (e.g., General Motors, Proctor & Gamble, and Hewlett-Packard) have traditionally allowed internal competition between subunits including divisions. For example, Hewlett-Packard has allowed its laser-jet printer division and ink-jet printer division compete against each other for printer markets. Intense competition among divisions, however, has become a problem, even for a company such as GM that has traditionally tolerated internal competition. Mr. Hoglund, GM's Executive Vice President points out (Cordtz, 1993: 22-25):

A few years ago GM had four different management systems, four different billing systems, three or four different materials scheduling systems for components – for no good reason. Chevy was trying to screw Pontiac, Olds was trying to screw Buick and Fisher Body was screwing all of us. Under the old system, with all our problems we'd all just be working harder to kill one another. *Now we are trying to convince people in the divisions that they don't have to fight each other, that they can concentrate on fighting other manufacturers.* We're making progress, but there's still a question that our progress is good enough. (Italics are mine)

As can be seen in the above quote, firms have good reasons to avoid, or at least, sever internal competition. First, internal competition among divisions may result in inefficient use of resources from the perspective of the firm. Inefficient use of resources can be thought of from factor-market and product-market perspectives. From a factor-market perspective, internal competition makes it hard for the firm to achieve economies of scope. Economies of scope can be achieved when subunits of the same firm share resources in their operations, and achieving economies of scope is one of the primary reasons why firms operate in multiple businesses (Teece, 1980). However, when internal competition is high, subunits are less likely to share resources or information, thereby increasing the firm's total cost of operation. And from a product-market perspective, internal competition can lead firms to introduce products with very similar features, which may end up cannibalizing one another's products (e.g., Copulsky, 1976). Thus, internal competition can decrease overall firm profits partly due to redundancy. For example, part of the reason the revenue from IBM's server group dropped from \$2.9 billion in the 3rd quarter of 1998 to \$2 billion in the same period of 1999 is due to internal competition and consequent redundancies between the AS/400 line and the Unix products (Korzewski, 1999).

Second, internal competition may foster subunit identification at the expense of organizational identification, which may hurt firm performance in the long run. Organizational identification is a "cognitive link between the definitions of the organization and the self," and can be regarded as "one form of psychological attachment that occurs when members adopt the defining characteristics of the organization as defining characteristics for themselves" (Dutton, Dukerich, and Harquail, 1994: 242). When a division competes against other divisions in the same firm, this division would be more con-

cerned with obtaining its own division goals, which may encourage the members of the division to identify themselves with their own division. As members identify themselves with their own division, they are more likely to evaluate the alternatives of choice in terms of their consequences for their own division (Simon, 1997) and focus their attention “on particular values, particular items of empirical knowledge, and particular behavior alternatives for consideration, to the exclusion of other values, other knowledge, and other possibilities.” (Simon, 1997: 288).⁹ This may create blind spots for divisions and end up creating excessive capacity in a firm (cf. Zajac and Bazerman, 1991). Excessive divisional identification further reinforces already intensified internal competition among divisions (cf. Dutton, et al. 1994).

Third, internal competition could exacerbate agency problems on the part of division managers. Internal competition may provide incentives for division managers to shirk their optimal behaviors. In compensation incentive design, it is important to link efforts and compensation or performance correctly. But internal competition makes it hard for corporate headquarters to link division managers’ efforts to their performance partly because a division manager’s performance is affected by other division managers’ efforts that work against the focal division manager’s performance, in addition to random factors such as market uncertainty (cf. Milgrom and Robert, 1992). And internal competition among divisions may increase influence costs. Influence costs occur because of influence activities that arise in organizations when (1) there is a central authority and the decision-making of this central authority affects the distribution of wealth or

⁹ Since organizational identification makes persons to focus on particular values or knowledge at the exclusion of the other alternatives, it may lead persons to wrong or biased decisions. Therefore, Simon (1997) further argues that one of the primary tasks of designing organizational structure is to specialize and subdivide activities in such a manner that the psychological forces of identification actually help people make correct decision-making, or at least minimizes decisional bias arising from the psychological forces of identification.

other benefits among members or constituent groups of the organization; and (2) in the pursuit of their selfish interests, the affected individuals or groups attempt to influence the decision to their own benefits (Milgrom and Roberts, 1992).¹⁰ Internal competition among divisions would intensify the pursuit of divisions' selfish interests, which would increase influence costs.

The above mentioned concerns would encourage corporate headquarters to check internal competition between divisions before it becomes excessive. Internal competition basically means high chances of inter-divisional product cannibalization. For a division that does cannibalize another division's products, inter-divisional product cannibalization is not a serious problem; it is rather a source of new revenues. But regardless of who cannibalizes whom, inter-divisional cannibalization could pose a serious problem for the firm as a whole. Thus corporate headquarters would exert pressure on divisions involved in inter-divisional cannibalization. Thus divisions' product location choices would reflect this pressure from corporate headquarters. Then how would this internal competition affect a focal division's new product location choice vis-à-vis the products of other divisions of the same firm?

¹⁰ For example, a division manager, who wants to secure resources for his division's project, tries to influence the decision by corporate headquarters by building the best possible case for its own project (e.g., the division has better investment opportunities due to its R&D personnel, production, or marketing capabilities so the resources necessary should be transferred from other divisions to its own), while hiding the potential difficulties of the project and at the same time trying to undercut the competing projects from other divisions of the same firm. In this case, influence costs come from several sources: (1) a central decision-maker and its supporting staff should spend time and resources to get the information about the project in question including competing ones; (2) the division manager expends resources to influence the decision-maker in its favor (if the division manager fails in influencing the decision in its favor, then the influence activities represent a cost without any offsetting gain; if the division manager succeeds in making the central decision-maker intervene inappropriately, then further costs occur due to bad decisions and their implementation); (3) if the central decision-maker recognizes the possibilities of influence activities and takes appropriate actions to control influence activities, these actions will bring additional costs to the organization.

This study argues that we can also get some implications by examining the nature of internal competition between a focal division and other division(s) in the firm. And the nature of internal competition would be better captured by the degree of a focal division's intra-firm divisional overlap with another or other divisions of the same firm. The literature on niche overlap and competitive dynamics suggests that a focal organization with a higher degree of overlap would feel more competitive pressure than one with a lower degree of overlap with the focal organization (e.g., Hannan and Freeman, 1989; McPherson, 1983; Baum and Korn, 1996; Chen, 1996). Thus we can expect that, as in inter-firm divisional domain overlap, a focal division with a higher degree of intra-firm divisional domain overlap with another division of the same firm would feel more competitive pressure and is more likely to act to take care of this pressure.

But, unlike in inter-firm divisional domain overlap, this competitive pressure from a high degree of intra-firm divisional overlap would not make a focal division to locate its product closer to the products of another division with which the focal division has domain overlap. The focal division would rather locate its new product farther away from another division's divisional domain as a way to lessen the competitive pressure from intra-firm divisional domain overlap. For a focal division, a high degree of intra-firm divisional overlap means that the chances of being cannibalized by another division are very high, which would motivate the focal division to act to reduce the chances of being cannibalized, i.e., move farther away from the other division's domain. And for a focal division, a high degree of intra-firm divisional overlap means that it would be extremely hard to determine the division's unique contribution to the overall firm performance, which may jeopardize the division's *raison d'être*. Thus a focal division with high degree of intra-firm divisional overlap has more incentives to locate its new product farther away from the products of other division with which it has divisional overlap.

Hypothesis 5. The *higher* the degree of a focal division's intra-firm divisional overlap with a sister division of the same firm, proportional to the focal division's domain, the *greater* the distance between the focal division's new product and the sister division's existing products.

This study also expects that the impact of a focal division's intra-firm divisional overlap on its new product location choice would be different depending upon its status in the firm. We could regard intra-firm divisional overlap between divisions as a manifestation of conflicts over their respective goals in the product markets, which needs to be resolved. Any kind of conflicts resolution in an organization involves politics at every level (Cyert and March, 1992), and subunits have different interests over the same information, the bargaining power of concerned parties being critical in the resolution (Arrow, 1974). Thus we can argue that a higher status division would likely have an upper hand in resolving conflicts over divisional domains with other lower status divisions of the same firm.

Related to the higher bargaining power or politics in solving conflicts between divisions, the literature on status provides some evidence. Weber (1968) and Coleman (1990) contend that individuals or groups with high social status receive favorable treatment by other parties in the same community who want to engage with them in social or economic interactions. Weber (1968) also argues that higher status holders have privileges that work for their own benefits, which is respected or recognized by lower status holders. Leffler, et al. (1982) also found that higher status holders are more likely to intrude upon other parties' space or interrupt other parties in their interactions than lower status holders. Thus we expect that in the presence of intra-firm divisional overlap, a higher status division would be less likely to move farther away from the products of a

lower status division with which it has overlapped domain. Specifically this study tests the following hypothesis.

Hypothesis 6. The *higher* the status of a focal division, the predicted relationship of intra-firm divisional overlap and intra-firm divisional new product distance (i.e., the *higher* the degree of a focal division's intra-firm divisional overlap with a sister division, the *greater* the distance between the focal division's new product and the sister division's existing products) will be *weaker*.

One of the primary tasks of corporate headquarters is coordinating divisional activities using control apparatuses such as incentives or disciplinary actions (Chandler, 1995[1962]; Williamson, 1975, 1985). Corporate headquarters can facilitate divisional cooperation by providing incentives that emphasize corporate-wide performance or foster internal competition through incentives that highly regard independent divisional performance (Hill, et al., 1992; Hambrick, 1994). This suggests that depending on the nature of incentives that are provided to corporate executives, divisions may be more tuned to cooperate with each other or pursue their own interests at the expense of other divisions.

When the incentives are to reward higher corporate performance, corporate executives or divisional managers would try to work toward increasing corporate performance. This implies that higher levels of inter-divisional product cannibalization would be less likely to contribute to increasing corporate-wide performance. Thus corporate executives may exercise their influence in reducing inter-divisional product cannibalization that is reflected in higher levels of intra-firm divisional overlap. And divisional managers whose divisions have higher levels of divisional domain overlap with other divisions would be under more pressure by corporate headquarters or have more incentives to re-

duce the level of divisional domain overlap with other divisions of the same firm. This idea leads to the following hypothesis.

Hypothesis 7. The *stronger* the emphasis of corporate incentive systems on firm-wide performance, the predicted relationship of intra-firm divisional overlap and intra-firm divisional new product distance (i.e., the *higher* the degree of a focal division's intra-firm divisional overlap with a sister division, the *greater* the distance between the focal division's new product and the sister division's existing products) will be *stronger*.

Up to now I have argued that firms have incentives not to intensify internal competition among divisions, which is reflected in the degree of divisional domain overlap inside the firm. But intra-firm divisional overlap usually happens and the degree of divisional domain overlap affects a division's product location choice. Related to intra-firm divisional domain overlap and consequent product location choice behavior of a division, this study further argues that the status of a division would affect the degree of divisional overlap that the focal division would have with other divisions of the same firm in the first place. The literature on product cannibalization provides some clues how the status of a division would affect the degree of intra-divisional overlap in the first place.

The literature on product cannibalization suggests that even though firms have incentives to avoid inadvertent intra-firm product cannibalization (Copulsky, 1976), there are certain situations that the firm may allow product cannibalization. First, when a new business opportunity emerges, multiple divisions in the same firm may attempt to exploit the opportunity and the firm may allow cannibalization in order to preempt that rising market segment, a scenario which may end up in intra-firm product cannibalization (Schwartz and Thompson, 1986; Baye, et al., 1996a, 1996b; Galunic and Eisenhardt, 1996, 2000). A case in point is the development and sales of small or compact car

by the Big Three in the U.S. automobile industry (Chandler, 1995[1962]). Second, if the total net profits or cash flows increase due to a new product introduction, internal competition between divisions and consequent intra-firm cannibalization could be tolerated (Traylor, 1986; Reddy, et al., 1994; Kerin, et al., 1978). For example, in their study on 75 brand line extensions by 34 regular filter brands in the cigarette industry during 1950-1984, Reddy, et al. (1994) found that intra-firm cannibalization didn't pose much negative impact on firm profits and line extensions into earlier subcategories actually may have helped the parent brand. Third, intra-firm cannibalization can be tolerated if competitive or sales objectives supersede profit objectives (Traylor, 1986; Nault and Vandenbosch, 1996; Chandy and Tellis, 1998; Kerin et al., 1978). Firms seeking long-term strategic benefit from an increase in its market share and market power may accept short-term losses resulting from cannibalization in so far as it stands to increase market power overall. Many firms have launched Internet businesses at the expense of losing sales in their established businesses, in part, to preempt Internet businesses before their rivals do.¹¹ Christensen (1997) demonstrates that cannibalization is necessary for the success of 'disruptive innovation' based on disruptive technology: a small independent organization that pursues a disruptive innovation should be allowed to compete against its parent or other divisions pursuing sustaining innovations. In sum, the literature on product cannibalization suggests that unless a new product introduction by a focal division achieves a competitive preemption, superior performance, or other strategic objectives, the firm may not allow intra-firm cannibalization that is reflected in intra-firm divisional domain overlap.

¹¹ Charles Schwab's schwab.com proved to be successful not only because it contributed to the increased sales of the firm at large after the short-term loss of its launch, but more importantly because it grabbed 42% of a new market that would otherwise have been dominated by upstarters like E*Trade (Useem, 1999).

With respect to the status of a firm and its impact on the initial intra-divisional overlap, the conditions of achieving superior performance and strategic objectives by a new product introduction deserve special attention. Achieving superior performance by introducing a new product suggests that a new product introduction into another division's divisional domain by a focal division and consequent intra-firm or inter-divisional product cannibalization may be allowed if the firm can produce net profits or cash flow due to the new product introduction, i.e., the newly introduced product should perform far better than cannibalized products of another division. The economic status of a division is determined by the economic performance of the division, and this economic status in turn affects the political status and prestigious status of the division inside the firm, or vice versa (cf., Benoit-Smullyan, 1944). Thus, a division with higher economic status has its current level of status primarily because its products have performed better than the products of other firms. This implies that it would be harder for a division to launch its new product into the divisional domain of a higher status division and expect its new product to perform far better than the cannibalized products of the higher status division. So the focal division may abstain from introducing a new product into the divisional domain of a higher status division. In addition to this, the political clout of a higher status division may deter the attempt of other divisions to launch a new product into its own divisional domain.

Another condition wherein the firm may allow inter-divisional product cannibalization is when the cannibalization has some strategic objectives that supersede at least short-term profit objectives. However, when a subunit pursues strategic objectives affecting a powerful subunit in a firm (i.e., the strategic objectives have potential for inter-divisional cannibalization), the subunit is usually faced with resistance and may not obtain sufficient resources that are necessary for implementing the strategic objectives. So

when a firm wants to successfully launch a disruptive technology that may cannibalize the firm's major product lines by a dominant division, the firm may better set up an autonomous organization (Christensen, 1997). And when a firm wants to launch a drastic innovation for market leadership, the firm should have a certain organizational culture such as "willingness to cannibalization" that fosters internal competition among strategic business units (Chandy and Tellis, 1998). So if the focal division wants to pursue a strategic objective that may cannibalize the products of a dominant division, corporate executives should provide support for the focal division or foster an atmosphere of willingness to cannibalization inside the firm. However, the dominant division may resist this by exercising its political clout based on political or prestige status in resource allocation to the strategic objective. This idea suggests that the chances that a lower status division launches a new product into the domain of a higher status division would be low in the first place, if not impossible. Thus, the following hypothesis is tested.

Hypothesis 8. The *lower* the status of a focal division, proportional to that of a sister division, the *greater* the distance will be between the focal division's new product and the sister division's existing products.

The hypotheses presented up to now intend to capture the impact of divisionalization and product cannibalization on product location choice. The hypotheses have suggested that with respect to divisionalization and product cannibalization, three factors may affect a division's product location choice: intra-firm status relative to other divisions, inter-firm divisional domain overlap, and intra-firm divisional domain overlap. This study expects that a division would be less likely to introduce a new product that may cannibalize its own products (i.e., intra-division product cannibalization). And it would also try a new product introduction that may avoid or at least reduce inter-

divisional cannibalization. However, a higher status division would be less restricted by the concern for intra-firm cannibalization than lower-status divisions and more likely try to introduce a new product that is distant from their current products, if necessary. On the contrary, lower-status divisions would be less likely to introduce a new product that may take sales from higher-status divisions. This internal consideration is augmented by an external consideration: inter-firm divisional overlap. A division with higher degree of inter-firm divisional overlap will be more likely to be aggressive and more likely to intrude rival divisions' territory, but this intrusion may be restricted if it triggers intra-firm cannibalization.

In summation, the hypotheses suggest that divisionalization shapes a division's behaviors toward other divisions (i.e., sister divisions) of the same firm, and toward its rival divisions, which consequently triggers competitive pressure from them. And these two behaviors affect the way the division locates its new products in the market. Thus, the hypotheses provide a clue to how the way a firm divisionalizes itself may affect the firm's competitive behaviors in the product market in the context of choosing the location of its new product.

CHAPTER IV

RESEARCH METHODS

Sample Description

U.S. automobile industry

This study collected data from the U.S. automobile industry.¹² Here the U.S. automobile industry includes not only U.S. automobile manufacturers but also foreign automobile manufacturers that sell their products in the U.S. The U.S. automobile industry can be characterized as a marriage of two concepts: one by GM that emphasizes the production of a large number of different types of cars; and the other by Ford that stresses the large-scale production of a standard line of cars (Friedlaender, Winston, and Wang, 1983). Consequently the U.S. automobile industry is characterized by large-scale production of differentiated products. Each company produces and sells multiple products that have different characteristics from one another. No two products, by definition, can be identical, but should be different from one another to some extent. Some products may be quite different from one another (e.g., Lincoln Town Car vs. Ford Escort), whereas some others may share quite similar characteristics (e.g., Ford Taurus vs. Mercury Sable).¹³ This fact that the U.S. automobile industry produces multiple products with differentiated characteristics makes it a good empirical setting to test hypotheses on product differentiation.

¹² For an excellent treatment of the U.S. and the world automobile industries, readers are referred to Abernathy (1978), Clark and Fujimoto (1991), Clark, Chew, and Fujimoto (1987), and Clark (1983).

¹³ As of 1997, Lincoln Town Car belongs to Luxury market class, whereas Ford Escort belongs to small car market class. And Ford Taurus shares the same platform with Mercury Sable.

In addition to the fact that the U.S. automobile industry is characterized with multiple products with differentiated characteristics, many firms have multiple operating divisions that produce and/or sell vehicles to the U.S. customers. In 1997, GM produced vehicles in 6 different divisions: Buick, Cadillac, Chevrolet, Oldsmobile, Pontiac, and Saturn. And Chrysler had two divisions: Chrysler-Plymouth-Jeep-Eagle Division and Dodge Division. Ford has traditionally two operating divisions: Ford Division and Lincoln-Mercury Division. And several foreign firms use more than one division to sell their cars in the U.S.¹⁴ Starting in the late 1980s, Toyota has run Toyota Division and Lexus Division; Nissan has operated Nissan Division and Infiniti Division; and Honda has run Honda and Acura Divisions. And until the mid-1980s, Volkswagen had used Audi and Porsche Divisions in selling their cars in the U.S. The fact that major players in the industry have multiple operating divisions makes the industry a good empirical setting to test the predictions on the effects of divisionalization.

In summation, the existence of multiple differentiated products and distinct multiple divisions makes the U.S. automobile industry an ideal setting to test the hypotheses. Regarding sample characteristics, a couple of things should be noted. First, since the hypotheses explicitly test the role of divisions, the sample only includes those firms with multiple divisions. Second, the study focuses on passenger cars in the traditional sense. So SUVs, vans, and light-duty trucks (e.g., pickup trucks) were excluded from the sample. Thus, whenever the study mentions vehicles, cars, or automobiles, they all refer to *passenger cars*.

¹⁴ This information is based on *Market Data Book 1998*, published by *Automotive News*.

Data

The study uses data on product characteristics for all car models sold in the United States between 1979 and 1999. The main data source for the product characteristics of the models is *Ward's Automotive Year Book (AYB)* which is supplemented by *Automotive News Market Data Book (MDB)*. Both publications are well-known and reliable yearly publications that have been used by many prior studies on the U.S. automobile industry (e.g., Berry, Levinsohn, and Pakes, 1995; Thomas and Weigelt, 2000). The data that came from these publications include car sales, model product specifications, car prices, and market class of each car, among others. Here market class is a segment of the market in which a car competes; this market class or segment is determined by vehicle size, price, and marketing intent.

Product characteristics of car models include weight, wheelbase, horsepower, length, height, width, engine displacement, and EPA (Environmental Protection Agency) miles per gallon rating. In addition to these characteristics, the data include information about automobile capacity such as fuel tank (U.S. gallons) or cooling system. It also includes some information about optional equipments such as automatic transmission, power steering, and air conditioning. Among these characteristics, I use wheelbase, horsepower, length, width, and MPG (miles per gallon) in calculating product distances of any two car models (cf. Berry, et al., 1995; Thomas and Weigelt, 2000).

Prices of each car model are base prices (i.e., list retail price of the base model) that include the manufacturer's suggested retail price and the destination charge, but do not include state and local taxes, or optional equipment. Actual transaction prices are preferred to the list price of the base model, but as Berry, et al. (1995) and Thomas and Weigelt (2000) have mentioned, the data on transaction prices of individual cars are hard

to obtain. And following prior studies, base model is defined as the least expensive version of the model – base model usually implies a two-door sedan or a car with a hatchback. Nominal prices were adjusted using the *Consumer Price Index* – all prices are 1983 constant dollars. Consequently, the product characteristics mentioned in the previous paragraph corresponds to the product characteristics of a base model.

The data also include information on sales. They have information on the number of units sold of each car model: the division that sold each car model. The data also specifies whether a certain car model was imported.

The data provide information on market class. For example, *Market Data Book 1998* classifies cars sold in 1997 into nine market classes¹⁵ based on vehicle size, price, and marketing intent: budget, small, lower mid-range, mid-range, upper mid-range, specialty, sporty, luxury, near luxury.¹⁶ Casual perusal of each market class shows that several divisions of the same firm compete in the same market class with different products. For example, in upper mid-range class, Ford Crown Victoria (Ford Div., Ford) competes with Mercury Grand Marquis (Lincoln-Mercury Div., Ford), Dodge Intrepid (Dodge Div., Chrysler) Chrysler Concorde (Chrysler-Plymouth-Jeep-Eagle Div., Chrysler),

¹⁵ In addition to nine classes for cars, *Market Data Book 1998* also classifies van and light truck classes as follows: Minivan, Full-sized van, full-sized pickup, full-sized sport-utility, compact sport-utility, small sport-utility, and compact pickup.

¹⁶ Each class includes a variety of cars. Budget class includes Chevrolet Metro, Nissan Sentra, and Ford Aspire among others; Small class includes Honda Civic, Hyundai Scoupe, Ford Escort, Dodge Neon, Saturn, and Pontiac Sunfire, among others; Lower mid-range includes Nissan Altima, Pontiac Grand Am, Ford Contour, Oldsmobile Achieva, Buick Skylark, and Chevrolet Corsica-Beretta, among others; Mid-range class has such cars as Ford Taurus, Chevrolet Lumina, Chevrolet Malibu, Buick Century, Ford Thunderbird, and Chrysler Cirrus, among others; Upper mid-range class includes Buick LeSabre, Ford Crown Victoria, Pontiac Bonneville, Chrysler Concorde, and Buick Roadmaster, among others; Specialty class includes Chevrolet Corvette, Jaguar, Dodge Viper, BMW Z3, and Plymouth Prowler, among others; Sporty class has such cars as Ford Mustang, Chrysler Sebring convertible, Chrysler Sebring coupe, Ford Probe, and Pontiac Firebird, among others; Luxury class includes Cadillac DeVille, Lincoln Town Car, Lincoln Continental, Oldsmobile Aurora, Cadillac Fleetwood, and Lexus LS 400, among others, and Near Luxury includes such cars as Buick Park Avenue, Chrysler New Yorker, Buick Riviera, BMW 3 series, and Oldsmobile Ninety Eight, among others.

Pontiac Bonneville (Pontiac Div., GM), and Buick Roadmaster (Buick Div., GM). We can see that a division competes not only with the models of rival divisions, but also with those of other divisions of the same firm (i.e., sister divisions) in the same market segment.

In addition to the information on car models and their characteristics, the data also include information on executive compensation. The information on executive compensation is from *Proxy Statements* filed with the Securities and Exchanges Commission. *Annual Proxy Statements* report compensation information on the five highest-paid executives of the publicly traded firm. The study uses compensation information on stock option and cash to capture a firm's incentives for cooperation among divisions for increasing overall firm performance.

The original data set covers years between 1979 and 1999 and consists of 3,379 observations. Each observation corresponds to each car model offered by a division into the U.S. automobile markets (passenger car markets to be exact). And each observation includes information about the firm and the division of a car model in question, its specifications and base prices, and identifies whether this car model is newly introduced in a given year. Following Berry, et al. (1995) and Thomas and Weigelt (2000), it is assumed that a car model is a new one if it meets one of the two conditions: (1) it bears a new name that didn't appear in previous years; or (2) its horsepower, width, length, and wheelbase has changed more than 10 percent in comparison with a model bearing the same name in the previous year.

Out of these 3,379 observations, I excluded those observations of car models that have been offered by single-division firms, which reduced the number of observations to

2,323.¹⁷ And out of these 2,323 observations, I only used observations with *new* car models. Thus, this study ended up with 163 observations which constitute the base data.

The unit of observation for the base data is *model-year*. We could index an observation of this data set as *imt*, where *i* refers to a focal division; *m* is a *new* car model of this division; and *t* refers to year. This base data set is constructed to test hypotheses about the distance of a *new* product of a focal division and this focal division's existing products, i.e., intra-divisional new product distance (Hypotheses 1 & 2).

To test the remaining hypotheses that require dyadic relations between divisions, two additional data sets were created from the base data set. First, I created a data set to test hypotheses about new product distances vis-à-vis rival products (Hypotheses 3 & 4). The unit of analysis for this data set is *inter-firm division dyad-model-year*. We could index an observation of this data set as *irmt*, where *ir* is a division dyad between focal division *i* and rival division *r*; *m* is a *new* car model of focal division *i*; and *t* refers to year. This data set has 1,780 observations. Divisions *i* and *r* should come from a firm that has multiple divisions.

Second, another data set was created to test hypotheses about product distances vis-à-vis the products of sister divisions (i.e., other divisions of the same firm) (Hypotheses 5 through 8). The unit of analysis is *intra-firm division dyad-model-year*. We could index an observation of this data set as *ijmt*, where *ij* is a division dyad between focal division *i* and sister division *j* of the same firm (*ij*); *m* is a *new* car model of focal division *i*; and *t* refers to year. This data set has 297 observations.

¹⁷ These 3,379 observations were used in calculating the scalar quality index of a car model. Table 1 has information about the descriptive statistics and correlations coefficients on price and product characteristics used in the calculation. And Table 2 shows the results of instrumental variable estimation based on the original 3379 observations.

Operationalization of Variables

Dependent variable

Product distances ($NEWDIST_{im}$, $NEWDIST_{im}$, $NEWDIST_{ijm}$) Dependent variables of the study are the distances between a *new* car model in question and (1) the same division (intra-divisional distance), (2) a rival division (inter-firm divisional distance), and (3) another division that belongs to the same firm (intra-firm divisional distance). These measures were calculated through the following procedures.

First, I calculated the scalar utility index of each car model. To measure the utility, I estimated the following equation which is due to Berry, et al. (1995).¹⁸

$$\ln P_{mt} = \alpha + \beta' \mathbf{x}_{mt} + \gamma \cdot s_{mt} + \delta \cdot t_{mt} + \varepsilon_{mt} \quad (4.1)$$

$\ln P_{mt}$ is the log-transformed real price of car model m at year t ; \mathbf{x}_{mt} is the vector of product attributes of car model m at year t ; s_{mt} is the market share of car model m in terms of units sold at year t (i.e., units-sold of car model m divided by total number of units sold in the market); and t_{mt} is a trend variable (calculated by subtracting 1977 from t). (Some issues in estimating the equation (4.1) will be discussed in the next section on statistical techniques.)

The observable utility of a car model is captured by $U_m = \beta' \mathbf{x}_m$, where the vector includes wheel base, length, width, horse power, and miles per gallon efficiency of the model. This measure of utility of each model U_m reflects a different magnitude of im-

¹⁸ This form was used by Thomas and Weigelt (2000) in their calculation of the quality measure of a car model. The function is composed of two additive terms: product characteristics and consumer characteristics.

pect of each product attribute (i.e., dimension), which is represented by β' in the equation. In other words, the measure captures the willingness of consumers to pay more on certain product attributes than other attributes.¹⁹ In essence, the measure is a reduction of n-dimensional product attributes into a scalar with the consideration of demand and equilibrium price: *utility*. Thus, U_m represents a location on one-dimensional product space defined by utility; we can represent the product location of each car model as a point on this one-dimensional space.

Since each model has its own utility index (or a point on the one-dimensional product space defined by utility), it is straightforward to calculate the distance between any two models. The distance between car models m and n in a given year is the difference of their respective utility.²⁰

$$D_{mn} = |U_m - U_n| \quad (4.2)$$

We need to calculate the distance between a car model in question and a division. Note that this division could be the one to which this car model belongs (i), or another division of the same firm (j), or a rival division of a competing firm (r). A division usually manages multiple car models, so we should decide specifically how to measure the distance. I use the *minimum* distance of all possible pair-wise distances between a car

¹⁹ It should be noted that the level of quality due to product attributes would not necessarily coincide with the utility level of a product when there exists decreasing marginal utility. Thus, above a certain threshold, a firm may substantially increase the quality of its new car model over old ones by enhancing the product attributes, but not as much as when it comes to the utility level.

²⁰ I adopted this way of calculating product distances from Thomas and Weigelt (2000). But instead of using their notion of 'quality,' I use the term 'utility.' So here product differentiation is a function of the difference of utilities between two products, not just of the difference of product attributes. This is to consider the situation that products have decreasing marginal utility. In the case of decreasing marginal utility, which is usually the case, moderate differences in product attributes may have very small differences in utility. Equation (4.1) basically calculates the impact of product attributes on price with the consideration of market demand. This market demand should capture, at least in part, decreasing marginal utility.

model in question and the models of a division as the distance between the model and the division (cf. Thomas and Weigelt, 2000).

I calculated intra-divisional distance of a *new* car model (i.e., distance between a *new* car model in question and its own division) as follows.

$$D_{im} = \min(D_{im,i1}, D_{im,i2}, \dots, D_{im,ip}), \text{ where } m, p \in i \text{ \& } m \neq p.$$

$$\text{NEWDIST}_{im} = \begin{cases} D_{im}, & \text{if } m \text{ is a new model} \\ ., & \text{otherwise} \end{cases}$$

Here D_{im} refers to the intra-divisional distance of car model m that belongs to division i ; any car model, regardless of new or old ones, should have this intra-divisional distance. NEWDIST_{im} is the variable of interest, which captures the product distance between a *new* model m and other models in the same division. When model m is not a new one, this variable would have no value.

And inter-firm divisional distance of a *new* car model (i.e., distance between a *new* car model in question and a rival division) was calculated as follows.

$$D_{irm} = \min(D_{im,r1}, D_{im,r2}, \dots, D_{im,rp}), \text{ where } m \in i, p \in r.$$

$$\text{NEWDIST}_{irm} = \begin{cases} D_{irm}, & \text{if } m \text{ is a new model} \\ ., & \text{otherwise} \end{cases}$$

Here D_{irm} represents the inter-firm divisional distance of car model m of division i with respect to rival division r . Note that $D_{im,rp}$ is the pairwise distance between car model m of division i and car model p of rival division r . Any car model, regardless of new or old ones, should have this inter-firm divisional distance with each rival division. NEWDIST_{irm} is the variable of interest, which captures the product distance between a *new* model m and rival division r . When model m is not a new one, this variable would have no value.

Lastly, I calculated intra-firm divisional distance of a *new* car model (i.e., distance between a *new* car model and another division of the same firm) as follows.

$$D_{ijm} = \min(D_{im,j1}, D_{im,j2}, \dots, D_{im,jp}), \text{ where } m \in i, p \in j; i, j \in f.$$

$$\text{NEWDIST}_{ijm} = \begin{cases} D_{ijm}, & \text{if } m \text{ is a new model} \\ \cdot, & \text{otherwise} \end{cases}$$

Here D_{ijm} represents the intra-firm divisional distance of car model m of division i with respect to division j of the same firm f . Note that $D_{im,jp}$ is the pairwise distance between car model m of division i and car model p of division j . Any car model should have this intra-firm divisional distance with each division of the same firm. NEWDIST_{ijm} is the variable of interest, which captures the product distance between a *new* model m and sister division j . When model m is not a new one, this variable would have no value.

In summation, since this study is concerned with the location of a car model vis-à-vis its own division, sister divisions (of the same firm), and rival divisions, each car model should have three types of distances as defined in the above. And since the focus of this study is on the product location choice of *new* car models, only the distances between a new car model and existing products are included for analyses.

Independent variables

Intra-firm divisional status (STATUS) Prior studies have measured that at the organizational level the status of a firm is identified by its position in the network of organizations (e.g., Podolny, 1993, 1994), which is the standard measure for relational data on status suggested by Bonacich (1987). This study defined the status of a division

as the division's relative standing in the economic, political, and prestige hierarchies. According to the literature on status (Podolny, 1993, 1994; Benoit-Smullyan, 1944), these three dimensions of status are intertwined since each reinforces one another, even though each dimension is a distinct one. For example, economic status would bring in political power, or vice versa. And political power could bring in prestige. This suggests that one dimension of status could capture the essence of status. Based on this, the status of a division was measured on the economic dimension: economic status.

The usual measure of economic status for an individual has been her income. Analogous to this traditional measure at the division level would be each division's income. Specifically, this study argues that the economic status of a division would be determined by how much that division contributes to overall firm performance. Ideally this should be measured by the division's contribution to overall firm profits. But due to data availability, each division's contribution to overall firm performance or profits was measured by its contribution to overall firm revenues (i.e., each division's total revenue divided by overall firm revenues). Each division's revenue was calculated by multiplying the number of units sold by the base price of each model in a given year.

Inter-firm divisional overlap ($OVERLAP_{ir}$) The literature on competitive dynamics suggests that the same absolute level of market overlap between any two organizations could be considered different depending on each organization's scope of market domains. For example, the same level of market overlap between organizations A and B (say 10 markets) could be huge for A which operates in 20 markets, whereas the overlap could be not so serious for B which operates in 100 markets. That is, market overlap is *asymmetric*. So the measure of divisional overlap should be able to reflect this asymmetry.

To meet this constraint, I calculated the degree of inter-firm divisional overlap (i.e., the degree of divisional overlap between a focal division and a rival division of a competing firm) using Sohn's (2001) formula for niche overlap measure. This measure appropriately handles the patterns of dominance and unequal overlap between two firms. Using data on patient origins of six hospitals in Los Angeles area, Sohn demonstrated that symmetric measures such as Euclidian distance (e.g., Burt, 1992; Burt and Talmud, 1993), cosine of the angle (e.g., Pianka, 1973), and alpha coefficient (MacArthur and Levins, 1967) did not adequately capture the patterns of dominance and unequal overlap between two compared firms.

Inter-firm divisional overlap between focal division i and rival division r was measured using Sohn's (2001) competition coefficient measure. Specifically I used the following formula (see Equations 6 and 7 in Sohn (2001) for more detail).

$$\text{OVERLAP}_{ir} = \frac{\sum_n P_{in} \cdot \text{Min}(P_{in}, P_{rn})}{\sum_n P_{in}^2}, \forall P_{in} > 0.$$

$$\text{where } P_{in} = \sum_{m \in n} (\text{UNITS SOLD})_{im} \cdot (\text{BASE PRICE})_{im},$$

i = division index

m = car model

n = market class/segment.

Here OVERLAP_{ir} represents the degree of inter-firm divisional overlap between focal division i and rival division r ; this measure captures the level of competitive pressure that the focal division receives from the divisional domain overlap with division r . The value is asymmetric (i.e., $\text{OVERLAP}_{ir} \neq \text{OVERLAP}_{ri}$), which is one of the advantages that this measure has over other traditional measures.

OVERLAP_{ir} takes the value between 0 and 1; the higher the value, the more focal division i receives competitive pressure from the overlap with rival division r .

As shown in the above formula, P_{in} equals to the total sales volume (\$) of division i in market segment n . From the standpoint of population ecology, P_{in} represents resource utilization levels of division i at resource segment n .²¹ I used the classification of market class or segment (resource segment for population ecology terminology) done by *Ward's Automotive Yearbook* for each year.²²

Intra-firm divisional overlap (OERLAP_{ij}) Intra-firm divisional overlap (i.e., the degree of divisional overlap between focal division i and another division j of the same firm) was also measured using Sohn's (2001) competition coefficient measure. Thus, the variable intra-firm divisional overlap is calculated as follows.

$$\text{OVERLAP}_{ij} = \frac{\sum_n P_{in} \cdot \text{Min}(P_{in}, P_{jn})}{\sum_n P_{in}^2}, \forall P_{in} > 0.$$

Here OVERLAP_{ij} represents the degree of divisional overlap that focal division i has with division j of the same firm and captures the level of competitive pressure from the divisional domain overlap with division j . As is OVERLAP_{ir}, OVERLAP_{ij} is not symmetric either (i.e., OVERLAP_{ij} ≠ OVERLAP_{ji}). And

²¹ In this respect, the current measure is better than the one suggested by McPherson (1983). McPherson's (1983) measure captures the asymmetric nature of niche overlap between two organizations, but it ignores resource utilization levels at each resource position (Sohn, 2001).

²² Here the market segment classification is critical in determining the level of divisional domain overlap. The underlying assumption for this measure is that car models that belong to the same market segment are direct competitors to one another. The classification is the outcome of various considerations such as price, product characteristics, target customers, marketing intent, among others. In a phone conversation, a representative from *Ward's Automotive Yearbook* confirmed that car models in the same market segment are direct competitors.

OVERLAP_{ij} takes the value between 0 and 1; the higher the value, the more focal division *i* receives competitive pressure from the overlap with division *j* of the same firm.

Competitive uncertainty (COMPUN) Many scholars have suggested different ways of describing environments (e.g., Thompson, 1967; March and Simon, 1958; Dess and Beard, 1984). These different ways of describing environments could be classified into three categories: complexity, instability or dynamism, and resource availability (Sharfman and Dean, 1991). Here competitive uncertainty perceived by a firm is primarily concerned with the instability or dynamism in the part of the market where the firm is actively operating (i.e., the rate of unpredictable environmental change).

One way to capture the stability or dynamism in the part of the market where the firm is actively operating is to check the change in market shares of each model that belongs to the firm (cf. Klein, 1977). Wide swings in market share from the previous year to the current year imply a high level of rivalry in that part of the market where the firm offers its products and competes with rival products. For example, firms that only offer high-end products (e.g., luxury cars) would not be concerned with the intense competition and instability in the low-end market as firms offering low-end products (e.g., small cars) should be. Based on this reasoning, I measured the competitive uncertainty that a firm feels as follows.²³

$$\text{COMPUN}_{it} = \sum_m |\text{MS}_{fmt} - \text{MS}_{fm, t-1}|$$

²³ The formula is basically an adaptation of Klein (1977).

Here $COMPUN_{ft}$ denotes the competitive uncertainty of firm f at year t ; MS_{fmt} denotes the market share of model m of firm f at year t , which equals to the number of units sold of car model m divided by the total number of units sold in the market. The higher the value, the higher competitive uncertainty is in a given year for firm f .

Density of a division (DENSITY) One of the predictions of this study is that the density of a division would affect its decision on new product location vis-à-vis the products of a rival division. The density of a division should capture how closely each model is located to one another in the division. To reflect this idea, I measured the density by taking the average of the Euclidean distances of any two car models in the same division as follows.

$$DENSITY_i = \left(\frac{\sum_x \sum_{y \neq x} \sum_k (P_{xk} - P_{yk})^2}{\binom{X}{2}} \right) \times (-1).$$

Here $DENSITY_i$ denotes the level of density of division i . And X refers to the total number of products of division i . P_{xk} refers to the value of k -th product characteristic of product x . And after having calculated the mean distance among all products (car models) of the same division, the value was multiplied by (-1) for the sake of easy interpretation. The higher the value, the more crowded a division's domain is.

Compensation scheme (EXECCOMP) Following the suggestion of prior studies (e.g., Mitchell and Silver, 1990; Hambrick, 1994), I used the proportion of top executives' compensations tied to overall firm performance as a proxy to measure the orientation of corporate headquarters in facilitating the cooperation among divisions in

the firm. Consistent with prior studies on executive compensation (Balkin, Markman, & Gomez-Mejia, 2000; Finkelstein & Boyd, 1998), I weighted the total values of stock options by 0.25. Specifically the following formula was used for creating the measure as suggested.

$$EXECCOMP_f = \frac{\sum_e \left(\frac{(\# \text{ of Stock Options} * \text{ Exercise Price}) * 0.25}{\text{Cash} + (\# \text{ of Stock Options} * \text{ Exercise Price}) * 0.25} \right)_{fe}}{M}$$

Compensation scheme of firm f (**EXECCOMP**) is basically the average proportion of the total value of stock options across the executives commanding the five highest compensations in the firm. Here e refers to individual executive and M denotes the total number of executives whose compensation information is included in the calculation (M is usually 5). The higher the value, the stronger the firm is oriented to increasing overall firm performance.

Status difference (STATUSDIFF) Status difference compares the difference between two divisions that belong to the same firm. I calculated this measure by subtracting the status of focal division i from that of division j of the same firm. Thus, the higher the value, the lower the status of focal division i compared with division j .

Control variables

No. of division products (DIVPRODS) To capture the potential for economies of scope in producing and marketing a new car model, this study includes a vari-

able for the total number of car models offered by a division. The higher the potential for economies of scope, it is expected that (1) divisions are more likely to introduce a new car model in the first place; and (2) in case of new car model introduction, divisions are more likely to locate their products closer to their own products.

No. of other divisions' products (SISPRODS) To capture the potential for economies of scope of a division with other divisions of the same firm (i.e., sister divisions) in producing and marketing a new car model, this study includes the number of models offered by sister divisions of the same firm.

No. of rival products (RIVPRODS) If there are many rival products, this would increase the potential for competition, which may affect a division's new product location choice.

Trend (TREND) A trend variable was included to capture any systematic effects of trend. This variable was calculated by subtracting '1977' from the year in the observation.

In addition to the above listed variables for testing the hypotheses, the following variables were also created to obtain *the inverse of Mill's ratio* from probit estimation. This inverse of Mills' ratio was plugged into the main equations with the variables defined in the above.

New product introduction (NEWMODEL) This is the dependent variable for probit estimation and is a binary variable. This variable was coded 1 when a new car model was introduced; otherwise this variable was coded as 0. As mentioned in the previous section, it is assumed that a car model is a new one if it meets one of the two conditions: (1) it bears a new name that didn't appear in previous years; or (2) its horse-

power, width, length, and wheelbase change more than 10 percent in comparison with a model bearing the same name in the previous year.

Total number of products (MKTPRODS) This variable represents the total number of products (here car models) sold in the market in a given year. This variable was included as a proxy for the level of competition in the market. It is assumed that where there are many car models in the market, the potential for intense competitive would be high: the higher the value, the greater the level of (potential) competition is. Thus, it is expected that a high level of competition would lessen the possibility of new car model introduction in the first place.

Division size (DIVSIZE) This size variable represents the total number of units sold by a division for each year. This variable was included as a proxy for variable profits for a division (cf. Thomas and Weigelt, 2000). This variable was log-transformed.

Firm size (FIRMSIZE) To capture the potential for resource support from corporate headquarters, firm size was included as a control variable. It is assumed that firms with larger size will be better off providing resources for any innovative new product introduction, thus affect product location choice. However, it should be noted that there has been no agreement over the impact of firm size on innovation. This variable was log-transformed.

Fixed cost (FIXCOST) This variable is a proxy for fixed cost for car production. Following Thomas and Weigelt (2000), this variable was measured by dividing the market size (\$) by the total number of models for each year. This is a good proxy for fixed costs for a monopolistically competitive industry like the U.S. automobile industry (Thomas and Weigelt, 2000; cf. Salop, 1979). So it is expected that high a fixed cost would lead to a reduction in new product introductions.

Statistical Methods

Instrumental variable (IV) estimation

As mentioned in the previous section, I measured the product distance of any two car models by taking the absolute difference between their respective utility. And to create the utility index for each car model, I estimated the following equation which was adapted from Berry, et al. (1995) and Thomas and Weigelt (2000).

$$\ln P_{mt} = \alpha + \beta_1 wheelbase_{mt} + \beta_2 length_{mt} + \beta_3 width_{mt} + \beta_4 horsepower_{mt} + \beta_5 MPG_{mt} + \gamma_1 share_{mt} + \delta_1 trend_t + \varepsilon_{mt} \quad (4.3)$$

MPG stands for miles per gallon; and *share* represents market share of a model in terms of units sold. The dependent variable in the equation is log-transformed price. Since the price represents base price, options such as power windows are not included in the equation. (Descriptive statistics of the variables in equation (4.3) are reported in Table 1 at Appendix B.)

The specification of equation (4.3) makes OLS estimation inappropriate. The variable $SHARE_{mt}$ in equation (4.3) poses the problem of endogeneity, which would make OLS estimates inconsistent. Here the endogeneity comes from two sources: omitted variables and simultaneity. First, there could be product characteristics that affect market share, but were omitted in the current equation due to data availability. These characteristics could include such considerations as prestige or reputation. Since these unobserved product characteristics are correlated with market share and are lumped together in the error term, market share and the error term are correlated. Second, there is

an issue of simultaneity between market share and price. One of the key determinants of demand (i.e., market share) is the price, and vice versa.

To address the problem of endogeneity, I used instrumental variable (IV) estimation to obtain consistent estimates. The instruments for this estimation should have two properties: (1) the instruments should not be correlated with the error term ε_{mt} ; and (2) they should be correlated with market share. According to Wooldridge (2002), asymptotically we are always better off including more instruments, thus I included the instruments that had been used either by Berry, et al. (1995) or Thomas and Weigelt (2000). First, I included each of the five product attributes of a car model as instruments (five instruments); sums of each product attribute of the other cars of the same division (five instruments); sums of each product attribute cross all the rival cars (five instruments). Second, to take into account the potential economies of scale and scope of own firm and rival firms, I included the number of own-firm products and rival-firm products as instruments. Third, I also added the average values of each product attribute cross all models as instruments since these values affect a firm's cost (Thomas and Weigelt, 2000).

Heckman's two-step estimation

To model a division's new product location choice and test the hypotheses, I used Heckman's two-step estimation (or Heckit estimator). Heckman's two-step estimation has merits in this study over Thomas and Weigelt's (2000) logistic regression analyses. First, new car models that we observe are there in the first place because they have met certain requirements of the division and the firm. Thus, we could regard these new models were *selected* by its offering division and firm out of potential distribution of models. This calls for a correction for a potential sample selection bias. Second, this

study is concerned with the variation between new product distances as a function of divisionalization and cannibalization. By using Heckman's two-step estimation, we can put the dependent variable at the left-hand-side of the equation, rather than put it in the right-hand-side with a binary variable as a dependent variable for new product introduction. Heckman selection model is composed of two related models: regression model and selection model.²⁴

$$\text{Regression Model:} \quad y_i^* = \mathbf{x}_i \boldsymbol{\beta} + \varepsilon_i$$

$$\text{Selection Model:} \quad z_i^* = \mathbf{w}_i \boldsymbol{\alpha} + v_i$$

$$\text{where} \quad \begin{pmatrix} \varepsilon_i \\ v_i \end{pmatrix} \sim N \left[\begin{pmatrix} 0 \\ 0 \end{pmatrix}, \begin{pmatrix} \sigma_\varepsilon^2 & \rho\sigma_\varepsilon \\ \rho\sigma_\varepsilon & 1 \end{pmatrix} \right].$$

The basic assumption in the Heckman model is that the left-hand-side variable in the regression model (here y_i^*) is observed based on the value of the LHS variable in the selection model (here z_i^*). More specifically y_i^* is observed only when $z_i^* > 0$ (then $y_i = y_i^*$).

The errors are assumed to be bivariate normal as shown in the above. Note that the variance of v_i is assumed to be 1. This is because the variance cannot be estimated: the selection variable z_i^* is not usually observable, and we can only infer its sign but not its magnitude. Since the error term in the selection model is assumed to be normally distributed, selection model specifies a probit model where $z_i = 1$ when $z_i^* > 0$. The correlation coefficient ρ shows whether the two equations are independent of each other.

²⁴ The notations and explanations for Heckman's two-step estimation are from Greene (2000: 926-937) and Long (1997: 215-216). For Heckman's own treatment of this topic, please see Heckman (1979).

lation coefficient ρ shows whether the two equations are independent of each other. And the covariance is $\rho\sigma_\varepsilon$, which captures the magnitude and direction of selectivity effects.

Heckman's two-step estimation procedure is as follows (Heckman, 1979). First, obtain probit estimates in the selection model (here $\hat{\boldsymbol{\alpha}}$), and using these estimates, compute the inverse Mills ratio (or nonselection hazard) for each observation in the selected sample.²⁵ Second, augment the regression model with the computed inverse Mills ratio, and obtain the estimates by OLS estimation. The expected value of the observed y_i in the regression model could be expressed as follows (Greene, 2000: 930).

$$E[y_i | z_i = 1] = \mathbf{x}_i \boldsymbol{\beta} + \rho\sigma_\varepsilon \cdot \lambda_i.$$

The above expression suggests that sample selection problem could be regarded as an omitted variable problem, which is why OLS estimates are not consistent (Heckman, 1979). In sum, in the first step, obtain the probit estimates ($\hat{\boldsymbol{\alpha}}$) and then compute the inverse Mills ratio ($\hat{\lambda}_i$).²⁶ And in the second step, estimate $\boldsymbol{\beta}$ and $\rho\sigma_\varepsilon$ by OLS regression on \mathbf{x} and $\hat{\lambda}_i$. Note that when variable k belongs to both regression and selection equations, it has both direct and indirect effects on the mean value of y_i . The direct effect of the variable is captured by β_{ik} and the indirect effect is channeled by its presence in λ_i .

²⁵ Here inverse Mills ratio essentially captures the effect of truncation on the expected value of the truncated variable. As the area of truncation in the distribution gets smaller, inverse Mills ratio gets closer to 0 and the expected value of the truncated variable gets closer to the true mean, i.e., the effect of truncation diminishes (Long, 1997: 195-196).

²⁶ $\hat{\lambda}_i = \varphi(\mathbf{w}_i \hat{\boldsymbol{\alpha}}) / \Phi(\mathbf{w}_i \hat{\boldsymbol{\alpha}})$. Here the numerator is the density function for a standard normal variable and the denominator is the distribution function. This inverse Mills ratio is "a monotone function decreasing function of the probability that an observation is selected into the sample" (Heckman, 1979: 156).

Following the steps laid out in Heckman (1979), the following probit equation was estimated to obtain the inverse Mills ratio. This equation is a selection equation for regression equations.

$$NEWMODEL_{fimt} = \alpha_0 + \alpha_1 mktprods_t + \alpha_2 divprods_{fit} + \alpha_3 divsize_{fit} + \alpha_4 firmsize_{fit} + \alpha_5 fixcost_t + v_{fimt} \quad (4.4)$$

After having obtained the inverse Mills ratio using equation (4.4), I estimated three main equations with the calculated inverse Mills ratio included. Each equation corresponds to one of the three aspects of the product location of a new car model offered by division i : (1) intra-divisional new product distance (ii) – the distance between the new model and a car model that belongs to the same division i and that has the shortest distance with the new model; (2) inter-firm divisional new product distance (ir) – the distance between the new model and a rival car model that belongs to rival division r and that has the shortest distance with the new model in that rival division; and (3) intra-firm divisional new product distance (ij) – the distance between the new model and a sister car model that belongs to division j of the same firm to which division i belongs and that has the shortest distance with the new model in that division.

First, the following equation was used to model intra-divisional product distance (ii) and test Hypotheses 1 & 2. The unit of analysis for this equation is *model-year*.

$$NEWDIST_{fimt} = \beta_0 + \beta_1 divprods_{fit} + \beta_2 sisprods_{fit} + \beta_3 rivprods_{fit} + \beta_4 density_{fit} + \beta_5 trend_t + \beta_6 millsratio_{fimt} + \beta_7 status_{fit} + \beta_8 compun_{fit} + \beta_9 status_{fit} \cdot compun_{fit} + \varepsilon_{fimt} \quad (4.5)$$

Basically equation (4.5) is a regression equation whereas equation (4.4) is its selection equation. If there is a selection effect, the coefficient of inverse Mills ration

would be statistically significant. Car model-specific random effects GLS estimation was used to obtain the estimates for hypothesis testing.

Second, to model inter-firm divisional product distance (ir) and test Hypotheses 3 & 4, the following equation was used. The unit of analysis for the following equation is *inter-firm division dyad-model-year*. An observation is indexed as $irmt$, where ir is a division dyad between focal division i and rival division r ; m is a car model of focal division i ; and t refers to year.

$$\begin{aligned}
 NEWDIST_{firmt} = & \beta_0 + \beta_1 divprods_{fit} + \beta_2 sisprods_{fit} + \beta_3 rivprods_{fit} + \\
 & \beta_4 trend_t + \beta_5 millsratio_{fimt} + \beta_6 overlap_{firt} + \beta_7 density_{fit} + \\
 & \beta_8 overlap_{firt} \cdot density_{fit} + \varepsilon_{fimt}
 \end{aligned} \tag{4.6}$$

Equation (4.6) is a regression equation and equation (4.4) is its selection equation. Note that the measure capturing the degree of inter-firm divisional overlap is not symmetric (i.e., $overlap_{firt} \neq overlap_{frit}$). To obtain the estimates, I used car model-specific random effects GLS estimation. Since new models are included in multiple times due to the dyadic nature of the specification, each in reference to a rival division in question, the observations with the same new model are not independent of each other. For example, let's say a division has 5 rival divisions. Then, whenever this division introduces a new model, this model is included 5 times vis-à-vis each rival division. So it is necessary to let the residuals of the observations with the same new model correlate with each other. Car model-specific random-effects GLS estimation addresses this non-independence among the observations with the same new model.

Third, to model intra-firm divisional distance or inter-divisional distance (ij) and test Hypotheses 5 through 8, equation (4.7) was estimated. The unit of analysis for this equation is *intra-firm division dyad-model-year*. An observation is indexed as $ijmt$,

where ij is a division dyad between focal division i and sister division j of the same firm (ij); m is a car model of focal division i ; and t refers to year.

$$\begin{aligned}
 NEWDIST_{fijmt} = & \beta_0 + \beta_1 divprods_{fit} + \beta_2 sisprods_{fit} + \beta_3 rivprods_{fit} + \\
 & \beta_4 density_{fit} + \beta_5 trend_t + \beta_6 millsratio_{fimt} + \beta_7 overlap_{fijt} + \\
 & \beta_8 status_{fit} + \beta_9 overlap_{firt} \cdot status_{fit} + \beta_{10} execcomp_{fit} + \\
 & \beta_{11} overlap_{fijt} \cdot execcomp_{fit} + \beta_{12} statusdiff_{fijt} + \varepsilon_{fimt} \quad (4.7)
 \end{aligned}$$

Equation (4.7) is a regression equation and equation (4.4) is its selection equation. Note that the measures capturing the degree of intra-firm divisional overlap and status difference between two compared divisions are not symmetric (i.e., $overlap_{fijt} \neq overlap_{fjit}$, $statusdiff_{fijt} \neq statusdiff_{fjit}$). To obtain the estimates, I used car model-specific random effects GLS estimation. Since new models are included in multiple times, each in reference to a sister division in question, the observations with the same new model are not independent of each other. So it is necessary to let the residuals of these observations correlate with each other, which is what car model-specific random-effects GLS estimation is supposed to address.

CHAPTER V

RESULTS

This chapter reports the results of preliminary and main estimations, and provides proper interpretations of the results. First, the results of instrumental variable (IV) estimation and probit estimation are reported. IV estimation was done to obtain consistent estimates of product attributes, which were later used to construct the scalar utility index of each car model. The scalar utility index of each car model was, in turn, used to calculate the distance of any pair of car models. Probit estimates were obtained to calculate the inverse Mills ratio which was plugged in the regression equations for hypotheses testing.

Second, the results on the intra-divisional product distance are reported. Here I report the effects of divisional status and competitive uncertainty felt by a firm on a division's *new* product location choice vis-à-vis its own existing products (here car models). Third, this chapter reports the results on the inter-firm divisional product distance. Here this study is interested in whether the degree of a focal division's inter-firm divisional overlap with a rival division affects this focal division's *new* product location choice vis-à-vis the rival division's products. In addition to this, this chapter also reports whether the density of the focal division has moderating effects on the aforementioned relationship. Fourth, this chapter reports the results on the intra-firm divisional product distance. Here I report whether inter-divisional domain overlap would affect a division's *new* product location choice vis-à-vis its sister division's products. I also report whether there exist moderating roles of divisional status and executive compensation on the aforementioned relationship. In addition to these, it is also reported whether status difference

makes a significant impact on product location choice vis-à-vis sister divisions' products.

Instrumental Variable (IV) Estimation and Probit Estimation

Instrumental variable (IV) estimation

The very first step for the analyses is to construct a scalar utility index for each car model so that we can calculate the distance between any two car models by simply comparing their respective utility indexes. To create a scalar index for utility, I obtained the coefficients of each product attribute using IV estimator.

Table 1 summarizes descriptive statistics and correlation coefficients of the log price of a car, its product dimensions, market share, and trend variable (See Appendix B). The mean of *log-transformed price* of a car is 9.42, which is around \$12,333 (1983 constant dollars). The average market share of a car model in a given year is 0.6%. The correlation coefficients confirm some of our common experiences. For example, the negative correlation coefficient between *trend* and *market share* suggests that market share of each car has decreased as time went on in the past, which may be due to increased competition. The coefficient between *trend* and *mile per gallon (MPG)* suggests that, in general, overall MPG may not have increased in the past twenty something years. Total number of observations for IV estimation is 3,379.

Table 2 reports the results of instrumental variable (IV) estimation on the *log-transformed price* of a car model using the specification of equation (4.3) (See Appendix B). Note that the price was adjusted using *Consumer Price Index*. In the table, two sets of coefficients are reported for comparison: IV estimation coefficients and OLS coeffi-

cients. And each set of coefficients includes two versions of coefficients: raw and standardized coefficients. Standard errors are in the parentheses. The Hausman test at the bottom of the table shows that there exist systematic differences between the IV estimates and OLS estimates ($p < .01$), suggesting that IV estimation is consistent but OLS estimation is not. Henceforth I will focus on the interpretation of the IV estimates and will use them in calculating a car model's utility index.

The results in Table 2 show that wheel base and length of a car are statistically significant and positive in sign, suggesting that the longer the wheelbase and length of a car, the higher the price of that car model. These results are consistent with common expectations in the sense that luxury cars are usually longer than compact or lower class cars. And width was found to have a negative and statistically significant impact on the price, of which the result is a bit tricky to interpret. In hedonic pricing, it is usually the case that product attributes would have positive coefficients. The coefficient of horsepower confirms our expectation that cars with high horsepower are more expensive. Mile per gallon (MPG) that measures the level of fuel efficiency, however, was not found to be statistically significant. Trend variable shows that the price has increased in the past. Its coefficient indicates that the price has increase 0.7% each year during the research window. And the coefficient of market share suggests that car models with high market share usually have lower prices, which is not surprising. Note that here market share is based on units sold.

To compare the relative impact of each product attribute on the (log-transformed) price, the table also includes standardized coefficients. The results basically show that each dimension has a different impact on the price. The coefficients show that *horsepower* has the largest impact on price: one standard deviation increase in horse power would result in 0.6037 standard deviation increase in the price of a car model, when

other things were held constant. This magnitude of impact of horsepower on the price is three times larger than that of *length* which has the second largest coefficient (0.1782, $p < .01$). And wheel base has the magnitude of 0.0982, suggesting that one standard deviation increase in *wheel base* would result in the increase of log price by 0.0982 standard deviation. The attribute *width* also has very significant impact on the price, this time, negatively. Literally the coefficient says that if the width of a car gets wider by one standard deviation, the log price of the car would decrease by 0.087 standard deviation. This result is not consistent with our common experience, which is intriguing.

The coefficients of each product attribute were used in constructing the scalar utility index of each car model. Figure 5.1 through Figure 5.4 present the utility indexes of car models offered by major U.S. and Japanese automobile companies in 1996 (See Appendix A). Car models offered by the same division are included in a rectangular box with the division name; this rectangular box also represents the division's divisional domain. Note that the utility index is one-dimensional and is represented as a vertical axis, which is not shown in the figures. The higher the vertical position of a car is, the higher the utility of the car is. Thus, Crown Victoria has the highest utility among cars offered by Ford Division in 1996. Figure 5.2 depicts that Chevrolet Division (CV) has a very large divisional domain, whereas Dodge Division (DG) has a focused divisional domain with high level of divisional density (i.e., low product distances among models in the same box). Figure 5.3 compares GM and two Japanese companies, Toyota and Honda. Unlike GM, these two companies cover the market with two divisions: one for car models with higher utilities and the other for lower utilities; thus, not much overlap between the divisions of the same firm.

The utility indexes of car models were, in turn, used in calculating new product distances. For example, Cadillac (CA) introduced Catera in 1996. Casual inspection in-

dicates that, for the new model Catera, intra-divisional new product distance is the utility difference between itself and Eldora (i.e., shortest distance in the same division); intra-firm divisional new product distance vis-à-vis Buick Division (Oldsmobile Division) is the utility difference between itself and Le Sabre (Ols 88); and inter-firm divisional new product distance vis-à-vis Toyota Division of Toyota is the utility difference between itself and Supra. These new product distances become the dependent variables for the main analyses.

Probit estimation

The results related to probit analysis are reported in Table 3 and Table 4 (See Appendix B). Table 3 reports descriptive statistics and correlation coefficients of the variables. The table shows that there have been 163 new model introductions by firms with multiple divisions between 1979 and 1999. Note that the total number of observations is 4,996, which is different from the number 3,379 in Table 1. This is due to two reasons. First, it is because the probit analysis only included models that were offered by firms with multiple divisions, whereas IV estimation is based on all the models offered between 1979 and 1999 regardless of whether offering firms had multiple divisions. The exclusion of models offered by single-division firms reduced the number of observations to 2,323. Second, it is because, to meet a basic assumption of event history method, I expanded each model included in 2,323 observations so that each model is present during the research window (i.e., from 1979 to 1999). For example, if a model was introduced in 1985, this model is supposed to have value 1 for the variable *NEWMODEL* (which is a binary variable for new product introduction) in 1985 and 0 for the years between 1986 and 1999. In this case there is no observation for this model between 1979 and 1984. To

take care of this issue, I inserted observations for this model between 1979 and 1984 with the value of 0 for the variable NEWMODEL. In so far as the division that introduced this model is present during the period, these newly inserted observations should have values for division-level, firm-level, and market-level variables.

Table 4 reports probit estimates from equation (4.4). The results show that the number of division products (DIVPRODS) has a positive and statistically significant impact on the likelihood of new car model introduction (0.0339, $p < .05$), which may suggest the consideration of economies of scope in new model introduction (cf. Thomas and Weigelt, 2000). The coefficient of the variable for fixed cost in a given year (FIXCOST) is negative and statistically significant (-0.0006, $p < .01$), which is consistent with the expectation that high fixed cost would more likely to restrict new model introductions. Size variables were found to have different impacts on the likelihood of new model introductions. Table 4 shows that firm size (FIRMSIZE) has a positive, but marginal, impact on the likelihood of new model introductions. However, the result on division size (DIVSIZE) suggests that large divisions are less likely to introduce new models.

As explained in the previous chapter, the estimates in Table 4 were used in calculating the inverse Mills ratio for each *uncensored* observation. The total number of observed observations, i.e., uncensored observations is 163. These observations constitute the base data set for the main analyses.

Divisional Status and New Product Location Choice

Table 5 reports the descriptive statistics and correlation coefficients for the impact of divisional status and competitive uncertainty on a division's new product location vis-à-vis its own existing car models (See Appendix A). The total number of obser-

vations is 163, which represents the new model introductions the U.S. market between 1979 and 1999 by automobile companies who operated *multiple* divisions and sold automobiles in the U.S.

Even though it is not reported in Table 5, it is worth mentioning the descriptive statistics of the utility index of each car offered by firms with multiple divisions during the research window. The value ranges from 1 to 3.68 with the mean value of 1.88, which suggests that a substantial portion of car models are located in the lower part in the one-dimensional product space. And the table also reports the descriptive statistics of intra-division new product distance ($NEWDIST_{im}$). Its mean value is 0.11, which is quite small relative to the range of the utility index, which is 2.68. This may suggest that a division locates its new product quite close to its existing products to exploit capabilities (cf. Thomas and Weigelt, 2000).

Correlation coefficients in Table 5 show that the number of own division's car models (DIVPRODS), the number of rival products (RIVPRODS), density of division (DENSITY), inverse Mills ratio (LAMBDA), and status of division (STATUS) have negative correlations with a division's intra-division new product distance. LAMBDA has values ranging from 1.38 to 2.76 with the mean value of 2.18. Note that except for TREND, LAMBDA, and NEWDIST, all other variables were mean-centered for obtaining correlation coefficients and regression estimates to alleviate potential multicollinearity problems and to make the interpretation of regression estimates easy.

Table 6 presents the results of random-effects GLS estimation of equation (4.5) on intra-division new product distances (See Appendix B). The two columns, at the right-hand-side of the main variables of interest, represent hypotheses and their expected signs. Standard errors are in parentheses.

Model 1 is a baseline model that only includes control variables. The coefficient of the number of own division's car models (DIVPRODS) is negative and statistically significant (-0.0146, $p < .01$); and the coefficient of the number of sister models (SISPRODS) is positive and statistically significant (0.002, $p < .1$). And the coefficient of the density of a division (DENSITY) shows that the more crowded a division, the closer a new car model is located to its own division's existing models (-0.5114, $p < .01$), which is not consistent with the argument of product cannibalization that a division is less likely to introduce a new model that is a close substitute for its own division's existing products, especially when the division already has models that are quite close to one another. The coefficient of the inverse Mills ratio (LAMBDA) is negative and statistically significant (-0.2238, $p < .01$), suggesting the existence of selection or selectivity effects. The sign and magnitude of the coefficient implies that the larger the effect of truncation (i.e., the larger the area of truncation in the distribution), the shorter the distance of a new product vis-à-vis its own division's existing products becomes by 0.22 per unit change.

Model 2 introduces the status of a division (STATUS) to examine whether STATUS would have a positive and statistically significant impact on intra-divisional new product distance (Hypothesis 1). The coefficient is not statistically significant, thus Hypothesis 1 was rejected.²⁷ Note that there still exists selection effect, i.e., the variable LAMBDA has a statistically significant coefficient (-0.264, $p < .01$).

Models 3.1 and 3.2 were constructed to test Hypothesis 2.²⁸ Hypothesis 2 posits that when the competitive environments that surround a firm are highly uncertain or in-

²⁷ As stated, the variables of interest were mean-centered, which would make interpretation much easier, especially in the case of interaction terms.

²⁸ Note that due to some missing observations of the variable competitive uncertainty (COMPUN), total number of observations is different from previous models.

stable, i.e., when competitive uncertainty (COMPUN) is high, the expected effect of a division's status would be more pronounced. This is because the firm would be more likely to rely on higher-status division(s) for its future performance since these divisions have demonstrated their abilities to perform in the past. Thus, the firm would allocate more resources to its higher-status division(s), which in turn may allow these divisions to introduce a new product that could be far different from their existing products. Model 3.1 only includes COMPUN and examines its main effect. The coefficient is not significant. Model 3.2 introduces an interaction term between STATUS and COMPUN to test the moderating effect of COMPUN. The coefficient of the interaction term is not statistically significant. Thus, Hypothesis 2 didn't receive support. And note that the variable LAMBDA is no longer statistically significant, indicating the absence of selection effects.

The estimates reported in Table 6 are obtained by car model-specific random-effects GLS estimation of equation (4.5). To check whether the estimates would have been different if fixed-effects estimation had been used, I did a Hausman specification test on Model 3.2. The test results show that the random-effects estimates are not systematically different from the fixed-effects estimates ($\chi^2=6.81$, $df=9$; $p=.65$). And it should be noted that the selection effects across models is not stable or consistent as shown in the table, suggesting that sample selection might not be a serious issue for the estimation of equation (4.5).

In summation, the results in Table 6 show that Hypotheses 1 & 2 didn't receive support, at least from the current sample. The results didn't provide support for the idea that a division's status would allow the division to introduce a new product (here car model) farther away from its existing products. And the idea that the competitive uncer-

tainty felt by the firm would positively moderate the before-mentioned relationship didn't receive support either.

Inter-firm Divisional Domain Overlap and New Product Location Choice

Here the focus is to investigate a division's new product location choice vis-à-vis a rival division's products. Specifically this study is concerned with how the degree of divisional domain overlap between a focal division and a rival division would affect the focal division's new product location choice vis-à-vis the rival division's products. Here the results of Hypothesis 3 and Hypothesis 4 are reported. The unit of analysis for the data set to test these hypotheses is *inter-firm division dyad(ir)-model(m)-year(t)* and the total number of observations for the data set is 1,780.

Table 7 reports the descriptive statistics and correlation coefficients of the data (See Appendix B). The coefficients are pairwise in nature. The dependent variable inter-firm divisional new product distance ($NEWDIST_{irm}$) has the mean value of 0.155, which is larger than the mean 0.108 of intra-divisional new product distance ($NEWDIST_{im}$). This implies that, in general, divisions are more likely to locate their new products farther away from rival products than from their own products, *i.e.*, they *differentiate* their new products *farther away* from rival products than from their own products.

The correlation coefficients show some interesting results. The number of one's own division products (DIVPRODS) and the number of sister divisions' products (SISPRODS) have negative and significant correlations with the dependent variable (-0.17 and -0.12 respectively), indicating that *high* numbers of DIVPRODS and SISPRODS are correlated with *low* product differentiation with rival products (here car models). The variables of interest ($OVERLAP_{ir}$ and DENSITY) also have statistically

significant and negative correlations with the dependent variable. And the magnitudes of correlation coefficients suggest that multicollinearity would not be a serious issue, which is partly due to mean-centering of the variables.

Table 8 reports the results of car model-specific random-effects GLS estimation of equation (4.6) on inter-firm divisional new product distance ($NEWDIST_{irm}$) (See Appendix B). Model 4 is a baseline model and only includes control variables. The number of sister models (SISPRODS) has negative and statistically significant coefficient (-0.0021, $p < .05$), which implies that a focal division with average number of sister models would locate its new model *closer* to rival models, i.e., *less* product differentiation from rival models. Specifically the coefficient suggests that if a focal division has one more sister model than the average (which is 13.5), then this focal division's inter-firm divisional new product distance would decrease by 0.0021 (which is about 1.4% of the average inter-firm divisional new product distance). And the coefficient of the number of a division's own models (DIVPRODS) is negative and statistically significant (-0.0075, $p < .01$). These *might* be due to the focal division's motivation to avoid intra-divisional and inter-divisional product cannibalization. And trend variable (TREND) was found to have a positive impact on the dependent variable (0.0075, $p < .01$), suggesting that divisions have located its new models farther away from their rival models in recent years than in the past, i.e., more product differentiation from rival models *recently*.

Model 5 includes the variable $OVERLAP_{ir}$ to test Hypothesis 3. This hypothesis posits that a division with higher degree of inter-firm divisional overlap vis-à-vis a rival division is more likely to locate its new product closer to that rival division's divisional domain. The coefficient is statistically significant and the sign is consistent with the expectation (-0.1615, $p < .01$). Thus, Hypothesis 3 did receive support. The sign and magnitude of the coefficient indicate that when a division's degree of inter-firm divisional

overlap increases by one standard deviation (which is 0.32) from the average level of overlap, then the division's inter-firm divisional new product distance would decrease by 33.3% ($=0.32 \times -0.1615 / 0.155$) of the average distance.

Model 6.1 and Model 6.2 introduce the variable for divisional density (DENSITY) and test its moderating effect. Model 6.1 introduces the variable. The coefficient is negative and statistically significant (-0.1219 , $p < .01$), suggesting that the higher the density of a division, the closer the division would locate its new model to rival models, i.e., *less* product differentiation from rival models. The sign and magnitude of the coefficient indicate that when a division's level of density increases by one standard deviation (which is 0.12) from the average density, the division's inter-firm divisional new product distance would decrease by 9.7% of the average distance.

Model 6.2 introduces an interaction term to test Hypothesis 4. This hypothesis posits that a high level of the density of a division would strengthen the impact of inter-firm divisional overlap on the division's new product location choice vis-à-vis a rival division in question, i.e., the already negative impact would be more pronounced when the density is high. The coefficient is statistically significant, but the sign is not consistent with the prediction (0.3046 , $p < .01$). The magnitude and sign of the coefficient indicate that one standard deviation increase of the level of density would decrease the magnitude of the coefficient of $OVERLAP_{ir}$ by 0.0375 [$-0.1655 + 0.0375 (=0.123 \times 0.3046)$], which is the opposite of the prediction. Thus, Hypothesis 4 didn't receive support. Figure 5.5 depicts the moderating effect of divisional density on inter-firm divisional new product distance (See Appendix A).

Figure 5.5 tells a different but interesting story of the moderating effect of divisional density. Following conventions, two more slopes were drawn by adding and subtracting 1 standard deviation from the mean value of DENSITY, which is 0 (subscript M

represents the slope when DENSITY has the mean value; H depicts the slope of high density; and L for the slope of low density). The intercept term represents the situation when DIVPRODS, SISPRODS, and RIVPRODS are at their means (which is 0); and when TREND is at 10 (which is year 1988) and LAMBDA is at its mean (which is 2.21). Figure 5.5 shows that up to a certain level of $OVERLAP_{ir}$ (0.384 to be exact) high density strengthens the effect of $OVERLAP_{ir}$ on inter-firm divisional new product distance; but beyond that point low density strengthens the effect. Note that $NEWDIST_{irm}$ should be greater than or equal to 0, thus the portion of its prediction that is below 0 has no real meaning or significance.

The estimates reported in Table 8 are obtained by car model-specific random-effects GLS estimation of equation (4.6). To check whether the estimates would have been different if fixed-effects estimation had been used, I did a Hausman specification test on Model 6.2. The test results show that the random-effects estimates are not systematically different from the fixed-effects estimates ($\chi^2=1.55$, $df=2$; $p=.4608$).²⁹ And it should be noted that no selection effect was found for any model specification in Table 8, suggesting that sample selection might not be a serious issue for the current estimation.

In summation, the results in Table 8 show that the current sample supports Hypothesis 3, but not Hypothesis 4. It was found that the degree of inter-firm divisional overlap has a negative and statistically significant impact on a division's decision to locate its new models vis-à-vis its rival division in question. The level of density, however, was not found to have an expected moderating effect on this relationship. It should be noted, however, that up to a certain level of inter-firm divisional overlap, high density

²⁹ Note that model df for the Hausman test is 2. This is because all the variables except for OVERLAP-related variables were dropped in corresponding fixed-effects estimation.

has an expected moderating effect as shown in Figure 5.5. The results also show that the level of density has a main effect and this effect is consistent with the expectation (i.e., negative).

Intra-firm Divisional Domain Overlap and New Product Location Choice

Here the focus is to investigate how intra-firm divisional domain overlap or inter-firm divisional domain overlap would affect a division's new product location choice vis-à-vis its sister divisions of the same firm. Related to inter-divisional domain overlap, this study also tested the moderating effects of divisional status and a firm's executive compensation scheme. And it was also examined whether disparity in status between two sister divisions would affect a focal division's new product location choice behavior vis-à-vis the other. Specifically the results of Hypotheses 5 through 8 are reported here. The data set for testing these hypotheses has 297 observations and the unit of analysis for the equations is *intra-firm division dyad(ij)-model(m)-year(t)*.

Table 9 reports descriptive statistics and correlation coefficients (See Appendix B). The correlation coefficients are pairwise in nature. The dependent variable $NEWDIST_{ijm}$ has the mean value of 0.146, which is larger than 0.108 of intra-divisional new product distance ($NEWDIST_{im}$) and a bit smaller than 0.155 of inter-firm divisional new product distance ($NEWDIST_{jm}$). These results suggest that, in the U.S. automobile industry, on average, a division introduces a new model such that the new model is a bit more differentiated from rival models than from sister models (i.e., models offered by sister divisions of the same firm). And the descriptive statistics show that the mean value of intra-firm divisional overlap of a division ($OVERLAP_{ij}$) is 0.345, which means that, on average, 34.5% of a division's domain is overlapped with that of a sister division.

The dependent variable $NEWDIST_{ijm}$ has a negative and statistically significant correlation with intra-firm divisional overlap ($OVERLAP_{ij}$), which is not consistent with the expectation. And the dependent variable also has a positive and statistically significant correlation with an executive compensation scheme ($EXECCOMP_f$) that highly emphasizes cooperation among divisions (0.17, $p < .05$), which is consistent with our expectation. And the magnitudes of correlation coefficients suggest that multicollinearity would not be a serious issue, which is partly due to mean-centering of the variables.

Table 10 presents the results of car model-specific random-effects GLS estimation of equation (4.7) on intra-firm divisional new product location choice (See Appendix B). Model 7 is a baseline model for this part of the study and contains control variables. The coefficients of trend variable (TREND) and SISPRODS are statistically significant, but these results are not stable as can be in the following models.

Model 8 introduces the variable $OVERLAP_{ij}$ that captures the minimum distance between a new car model of focal division i and the car models of division j of the same firm. This model tests Hypothesis 5 which posits that division i with a higher level of divisional domain overlap with another division j of the same firm is more likely to locate its new product (i.e., new car model) farther away from the products of division j . The coefficient of $OVERLAP_{ij}$ is significant ($p < .01$), but the sign is not consistent with the expectation. Thus, Hypothesis 5 was rejected. The coefficient suggests that, contrary to our expectation, a higher level of inter-divisional overlap would make a division locate its new model closer to a sister division, i.e., *decreasing* product differentiation from the models of a sister division in question. Specifically the sign and magnitude of the coefficient (-0.2379) indicate that one standard-deviation increase of intra-firm divisional domain overlap (which is 0.304) from its average level would result in 49.5% (0.304*-

0.2379/0.146) decrease of the average new product distance vis-à-vis a sister division's existing products in question.

Model 9.1 and Model 9.2 introduce the variable STATUS and test its moderating role on the relationship between $OVERLAP_{ij}$ and $NEWDIST_{ijm}$. Hypothesis 6 predicts that a division's status in the firm would *weaken* the impact of the degree of intra-firm divisional overlap on the division's product location choice vis-à-vis the products of sister divisions. Model 9.1 introduces the variable STATUS. The coefficient is not statistically significant. And Model 9.2 includes the interaction term between STATUS and $OVERLAP_{ij}$. The coefficient of the interaction term is not statistically significant either. Thus, Hypothesis 6 was rejected.

Models 10.1 and 10.2 test the moderating role of executive compensation scheme ($EXECCOMP_f$). Hypothesis 7 states that executive compensation schemes that emphasize firm-level performance rather than division-level performance (i.e., cooperation oriented) would *strengthen* the impact of intra-firm divisional overlap on inter-divisional new product distance. Model 10.1 introduces the variable $EXECCOMP_f$. The coefficient is not statistically significant. Model 10.2 includes the interaction between $EXECCOMP_f$ and $OVERLAP_{ij}$. The coefficient is significant ($p < .05$), but its sign is not in the expected direction. Thus, Hypothesis 7 was rejected.

Model 11 introduces the variable STATUSDIFF to test Hypothesis 8 which states that the lower the status of division i , relative to that of division j , the farther away division i would locate its new product from the products division j . The coefficient is significant ($p < .05$), but its sign is not consistent with the prediction. Thus, Hypothesis 8 was rejected.

Model 12 is a full model for the current part of the study. In this model several coefficients, which were not significant in the previous models, became statistically sig-

nificant. STATUS became statistically significant (-0.7126, $p < .01$), suggesting that divisions with higher status would be less likely to differentiate their new models from the models of sister divisions than from divisions with lower status. This result is consistent with our prediction. The interaction term between $OVERLAP_{ij}$ and $EXECCOMP_f$ is statistically significant, but the sign is still in the opposite direction.

The estimates reported in Table 10 are obtained by car model-specific random-effects GLS estimation of equation (4.7). To check whether the estimates would have been different if fixed-effects estimation had been used, I did a Hausman specification test on Model 12. The test results show that the random-effects estimates are not systematically different from the fixed-effects estimates ($\chi^2 = 2.26$, $df = 4$; $p = .69$).³⁰ And it should be noted that no selection effect was found for any model specification in Table 10, suggesting that sample selection might not be a serious issue for the estimation.

In summation, this study didn't find support for the positive impact of the level of inter-divisional overlap on inter-divisional new product distances, at least from the current sample. Even though the hypotheses themselves were rejected, this study found a couple of interesting results. First, as in the case of inter-firm overlap ($OVERLAP_{ir}$) and inter-firm divisional new product distances ($NEWDIST_{irm}$), inter-divisional overlap between two divisions would make a division with higher level of overlap, proportional to its own divisional domain, to locate its new models closer to the other division's models, i.e., *less* product differentiation from the sister division's models and consequently more potential for inter-divisional product cannibalization. Second, the results showed that a division with lower status would not necessarily refrain from launching a new model that could be quite close to the models of a division with higher status.

³⁰ Note that model df for the Hausman test is 4. This is because all the variables except for OVERLAP-related variables and STATUSDIFF were dropped in corresponding fixed-effects estimation.

Summary of the Results

In the previous section the results of car model-specific random-effects GLS estimation were reported. In addition to this random-effects GLS estimation, I did a couple of additional analyses on the same specifications for comparison. First, I obtained OLS estimates to check whether there are any significant systematic differences in terms of magnitude and sign of the estimates. I spotted some changes in magnitude, but didn't find any changes in signs or significance level. Second, I ran a division-specific random-effects GLS estimation to take into account the fact that observations that belong to the same division are not independent from each other (i.e., errors are correlated) and to check whether there are any significant and systematic differences from the current estimates. Again I spotted some changes in magnitude, but didn't find any changes in signs or significance level.

In addition to a couple of additional analyses on the same specifications, I did a couple of extra analyses, this time, with slightly different specifications. First, I included a dummy variable for GM to check whether GM exhibits different behaviors. No clear systematic differences were found. And, I also estimated the equations using *lagged* main variables (3 year-lag) to take into account the time to develop a new car model and to check any systematic differences from the current results. I found no systematic differences from the current estimates in terms of sign and significance level.

In total, this study tested 8 hypotheses using Heckman's two-step estimation. The hypotheses, their predictions, and the results from the current sample are as follows.

TABLE 11
Summary of the Results

Hypotheses	Predictions	Results
Hypothesis 1	A division with higher status would locate its new products <i>farther</i> away from its own existing products (i.e., <i>more</i> intra-divisional product differentiation)	Rejected
Hypothesis 2	The expected effect of divisional status on intra-divisional new product distance would be <i>stronger</i> when competitive uncertainty is <i>high</i>	Rejected
Hypothesis 3	A division with a <i>higher</i> level of inter-firm divisional domain overlap with a rival division, proportional to its own divisional domain, would locate its new product <i>closer</i> to the rival division's products (i.e., <i>less</i> inter-firm product differentiation)	Supported
Hypothesis 4	The expected effect of inter-firm divisional overlap on inter-firm new product distance would be <i>weaker</i> when the density of a division is <i>high</i>	Rejected
Hypothesis 5	A division with <i>higher</i> level of intra-firm divisional overlap with a sister division, proportional to its own divisional domain, would locate its new product <i>farther</i> away from the sister division's products (i.e., <i>more</i> inter-divisional product differentiation)	Rejected
Hypothesis 6	The expected effect of intra-firm divisional overlap on inter-divisional new product distance would be <i>weaker</i> when the status of a division is <i>high</i>	Rejected
Hypothesis 7	The expected effect of intra-firm divisional overlap on inter-divisional new product distance would be <i>stronger</i> when a firm's executive compensation is <i>more</i> tied to overall firm performance	Rejected
Hypothesis 8	A division with <i>lower</i> status would locate its new products <i>farther</i> away from the products of a sister division with <i>higher</i> status	Rejected

CHAPTER VI

DISCUSSION AND CONCLUSION

In the previous chapter, I reported the results of Heckman two-step estimation. The results include the estimates of probit analysis (i.e., selection equation of Heckman two-step estimation) and car model-specific random-effects GLS estimates (i.e., regression equation). I mainly focused on the results of car model-specific random-effects GLS estimation and their proper interpretation since our main interest lies in the regression equation rather than the selection equation. In this chapter, I discuss the results reported in the previous chapter. The discussion is focused not only on the hypothesis that received support, but also on other interesting outcomes that may provide some insights on a division's new product location choice.

Implications

The main result of this study is that a division's inter-firm divisional overlap with a rival division would affect the division's new product location choice vis-à-vis that rival division: the higher the level of inter-firm divisional domain overlap of a focal division with a rival division, proportional to this focal division's own divisional domain, the closer this focal division's new product vis-à-vis that rival division's existing products. Here products are car models and a new product refers to a new car model.

This result of inter-firm divisional new product distance extends the arguments of divisionalization in industrial organization economics. IO economists have argued that divisionalization is more profitable than remaining as 'a unified whole' because a firm

with autonomous divisions ends up producing more products and consequently being more aggressive than firms without multiple divisions (Corchon, 1991; Schwartz and Thompson, 1986; Veendorp, 1991; Polasky, 1992; Baye, et al., 1996a, 1996b). The result of inter-firm divisional new product distance suggests that, at least in a differentiated product industry, a firm can become more aggressive than other firms by appropriately divisionalizing itself vis-à-vis competitors, without producing far more products than competitors. This study basically suggests that a firm could be more aggressive by splitting the product market such that its divisions would have a higher level of inter-firm divisional domain overlap with the rival divisions of a competitor.

This result on inter-firm divisional overlap also provides evidence of mimicry between firms with a high level of market overlap or multimarket contact (Greve, 1996), at the *division-dyad level*. A division's decision to locate its new product closer to rival divisions' products suggests that over time a division with higher degree of inter-firm divisional overlap with rival divisions of a competing firm may expand its divisional domain. Through a series of mimetic processes in new product location choice, the divisional structure or charters of competing firms would look more or less alike. And this may further lead to a long-term consistency between the organizational structures of competing firms.

Another interesting result, related to inter-firm divisional new product distance, is the impact of the density of a division in new product location choice. It was found that a division with a high level of divisional density (i.e., divisional domain is quite crowded with products) is more likely to locate its new car model closer to rival models. This result suggests that product proliferation and resultant high level of divisional density may not only dissuade potential entrants from entering the market (Schmalensee,

1978), but also persuade divisions to act aggressively toward rival divisions by locating their new products a little bit closer to rival products.

It should be noted, however, that it is not clear whether this result of divisional density also implies that divisions may take into account the possibility of intra-divisional cannibalization (i.e., cannibalizing their own products) when they locate their new product (here models). This is because it was also found that the level of divisional density had a *negative* impact on intra-divisional new product distance, suggesting that high-density divisions are more likely to locate their new products closer to their own products. Interestingly this study didn't find a significant result regarding the impact of divisional density on intra-firm divisional new product location choice.

In addition to inter-firm divisional issues, I also investigated a division's intra-firm divisional domain overlap and its impact on this division's new product location choice vis-à-vis a sister division. The results showed that the higher the level of a focal division's domain overlap with a sister division, proportional to its own divisional domain, the closer this focal division would locate its new car model to that sister division's existing models (i.e., *less* product differentiation), which is the *opposite* of the prediction. This result is not consistent with some of recent studies that found cooperation among divisions of the same studio in distributing movies (Corts, 2001) and franchisors' efforts to assign outlets to franchisees in such a manner to reduce intra-organizational multimarket contacts (Kalnins, 2003). One explanation for this finding is that this study is primarily concerned with divisionalization along with product markets, whereas Kalnins (2003) is focused on franchisees (units) that are based on geographic regions and Corts (2001) is concerned with divisions that don't have unique divisional charters.

Related to the negative impact of inter-firm divisional overlap on inter-firm divisional new product distance, the negative relationship between intra-firm divisional overlap and intra-firm divisional new product distance might be due to the common antecedent of capability overlap (cf. Thomas and Weigelt, 2000). Since divisions with a high level of divisional overlap (inter- and intra-) should have common capabilities which would make them introduce products with similar features, it might not be surprising to find that the level of domain overlap should have a negative effect on new product distances.

This result of intra-firm divisional new product distance, combined with low mean value of intra-divisional new product distance, may suggest that divisions are already very broadly defined. That is, even though divisions started with their distinctive divisional charters in the first place, over time they have tended to lose their initial focus. This has increased the potential for inter-divisional product cannibalization that may need corporate headquarters' intervention.

Another interesting result is the impact of status differences between two sister divisions on new product location choice. I expected that lower-status divisions would locate its new product farther way from the products of higher-status divisions; but the result turned out to be the *opposite*. This finding may be due to the use of a so-called global platform in the automobile industry. Usually an automobile firm develops a platform for multiple models to spread out the cost of new product development and introduction. Automobile firms usually build at least two versions: higher-end and lower-end versions. It is a kind of convention that high status divisions are responsible for marketing a higher-end version whereas low status divisions market a lower-end version. Since the two versions share the common platform, their product features are more likely to be

similar to each other, which may contribute to the negative relationship between status difference and new product distance vis-à-vis a sister division with higher status.

Contrary to the expectation, the results show that sample selection bias may not pose a serious problem in the current sample. Except for a couple of model specifications for intra-divisional new product distance, the other model specifications didn't produce statistically significant coefficients for the sample selection bias. This result is surprising in that the range of the inverse Mills ratio clearly suggests the existence of truncation effects. Regression diagnostics suggest that this result is not due to multicollinearity between the inverse Mills ratio and other explanatory variables in the regression equations. This result might have something to do with the probit model specification in the first place, judging from the low explanatory power of the probit model specification in predicting new car model introductions. This warrants further investigation, which is beyond the scope of the current study.

Limitations of the Study and Suggestions for Future Research

One of the limitations is about the generalizability of the results. This study used data on the U.S. automobile industry between 1979 and 1999. Specifically the data that were used in the analyses include observations of passenger cars (no SUVs, vans, or trucks) offered by the firms with multiple divisions, which may further limit the implications of the results. First, the exclusion of sing-division firms might not be a big issue for intra-divisional and intra-firm divisional new product distance and related estimations, since these two aspects of divisionalization, by definition, require the existence of multiple divisions. But the exclusion may raise an issue for inter-firm divisional new product distance and related estimation since the distance is calculated against the models of-

ferred by firms with multiple divisions, not by single-division firms. This could have inflated inter-firm distance, which might have downplayed the possibility and effect of competition with rival models. Second, the exclusion of SUVs and vans might have inflated the distances of a new model vis-à-vis its own division's and sister division's existing models since the divisions that offer passenger cars also offer SUVs and vans. And the inclusion of SUVs and vans might have affected the ranges of inter- and intra-firm divisional domain overlap since some divisions offer SUVs whereas other divisions don't, i.e., the variance of overlap measures would have increased. In summation, the inclusion of SUVs and Vans might have decreased the variance of the dependent variables (i.e., intra-divisional, inter-firm, and intra-firm new product distances) and at the same time it might have increased the variance of the variables of interest such as the degree of divisional overlaps (both inter-firm and intra-firm), which suggests that the current sample and estimations might have *understated* the true standard errors and consequently *overstated* the estimated significance levels.

Another limitation is that this study approaches divisionalization from three *separate* angles. And except for intra-divisional new product distance, the main focus is *division-dyad*. This approach is based on a rather strong assumption that a division can locate its new product in such a location that satisfies all three aspects *simultaneously*: intra-divisional distance, inter-firm divisional distance for sister division, and intra-firm divisional distance for any rival division. Without this strong assumption, division-dyad-based distance for intra-firm and inter-firm divisional new product distances might not make much sense.

And it should also be noted that I didn't model a firm's strategic decision that could have very broad ramifications over all divisions. A firm's strategic decisions that could charter new product categories would, in turn, affect a division's decision of prod-

uct location choice. This part of the equation is not explicitly addressed in the current study. For a more complete understanding of a division's product location choice, it is desirable to include this aspect.

The results provide several interesting future research topics. One such direction is about the distribution of divisional status among divisions in the firm and its impact on overall innovation activities of the firm. This would provide another way to look at innovation. If the status distribution is uniform, would this increase radical innovation or incremental innovation? If every division has roughly equal status relative to the others, we could expect that no single division could dominate the other divisions in the process of resource allocation for its own advantage. If resources are equally split, then we may not expect an architectural innovation from the firms with this kind of distribution. But we may expect a series of incremental innovations by each division to gain an edge over other divisions with equal status. Then how about a skewed distribution where one division holds very high status whereas others don't? The distribution of divisional statuses would dictate resource allocation, which would affect overall firm innovations.

And it would be interesting if future research can develop a holistic view on new product location by incorporating three aspects of divisionalization into one framework. By approaching divisionalization and its impact simultaneously, we could test whether three aspects of divisionalization would have an impact of different magnitudes and directions on new product location. For instance, we could test whether intra-firm divisional overlap has a significant impact on a division's product location choice vis-à-vis rival products or its own existing products, in addition to vis-à-vis a sister division's existing products. This might bring in new insights in understanding a division's product location choice.

Conclusion

This study argues that a firm's product location choice may be a function of the firm's way of splitting the product market (i.e., divisionalization) and the concern for product cannibalization at the division and the firm levels. The focus of this study is at the division level and a division's new product location choice vis-à-vis its own products (intra-divisional new product distance), the products of a rival division of competing firms (inter-firm divisional new product distance), and the products of a sister division of the same firm (intra-firm divisional new product distance). The hypotheses were tested using data on the U.S. automobile industry between 1979 and 1999.

This study found that a focal division with a high level of inter-firm divisional domain overlap with a rival division, proportional to the focal division's own domain, is more likely to locate its new product (here new car model) closer to that rival's existing car models. And it was also found that divisional density affects a division's new product location choice. But this study didn't find any significant role of divisional status on new product location choice. And contrary to our expectation, the results of intra-firm divisional domain overlap and new product location choice suggest that inter-divisional product cannibalization might not be such an important concern when divisions introduce their new products, as we had originally expected.

By addressing the firm's competitive engagement in the context of a division's new product location choice, this study expands the basic logic of market overlap at the firm level into the unit- or division-level, and highlights how a division's new product location choice is affected by intra-firm divisional structural relationship as well as inter-firm divisional structural relationship. In so doing, this study hopes to contribute to the

literature on divisionalization, new product location choice, competition at the unit-level, and product cannibalization, among others.

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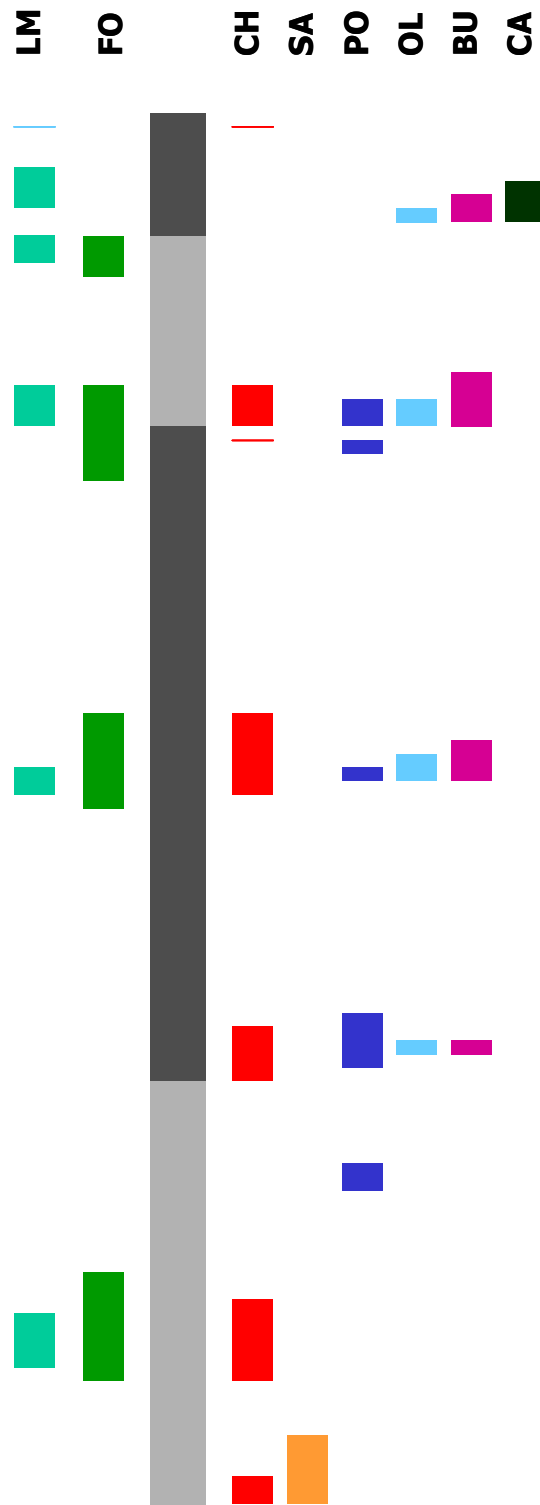
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APPENDIX A

FIGURES

FIGURE 3.1

Divisionalization: An Example (Ford vs. GM in 1992)



LM: Lincoln-Mercury Division

CH: Chevrolet PO: Pontiac BU: Buick

FO: Ford Division

SA: Saturn OL: Oldsmobile CA: Cadillac

FIGURE 3.2
A Conceptual Model for the Study

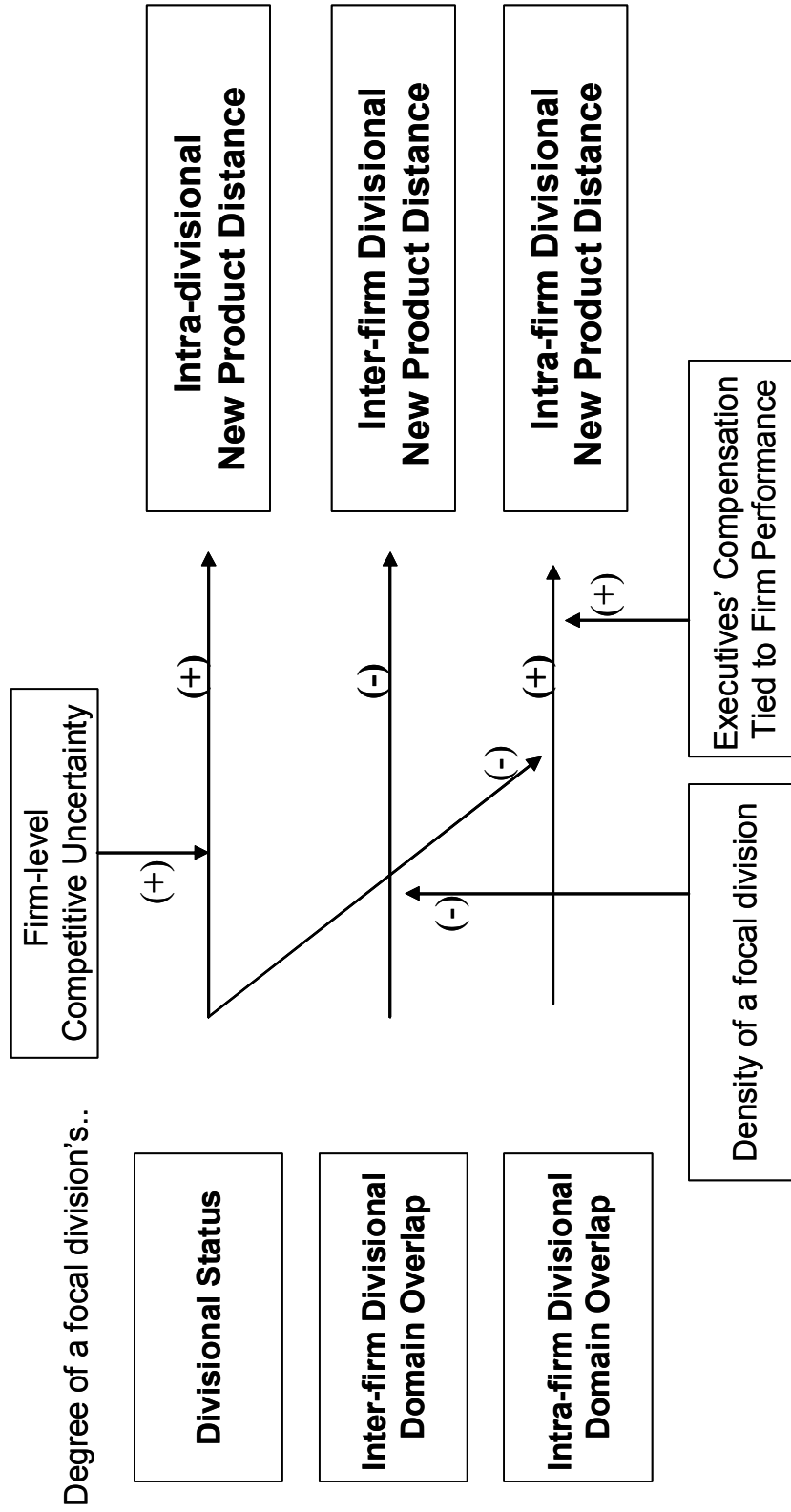


FIGURE 5.1
Utility Index: GM vs. Ford (1996)

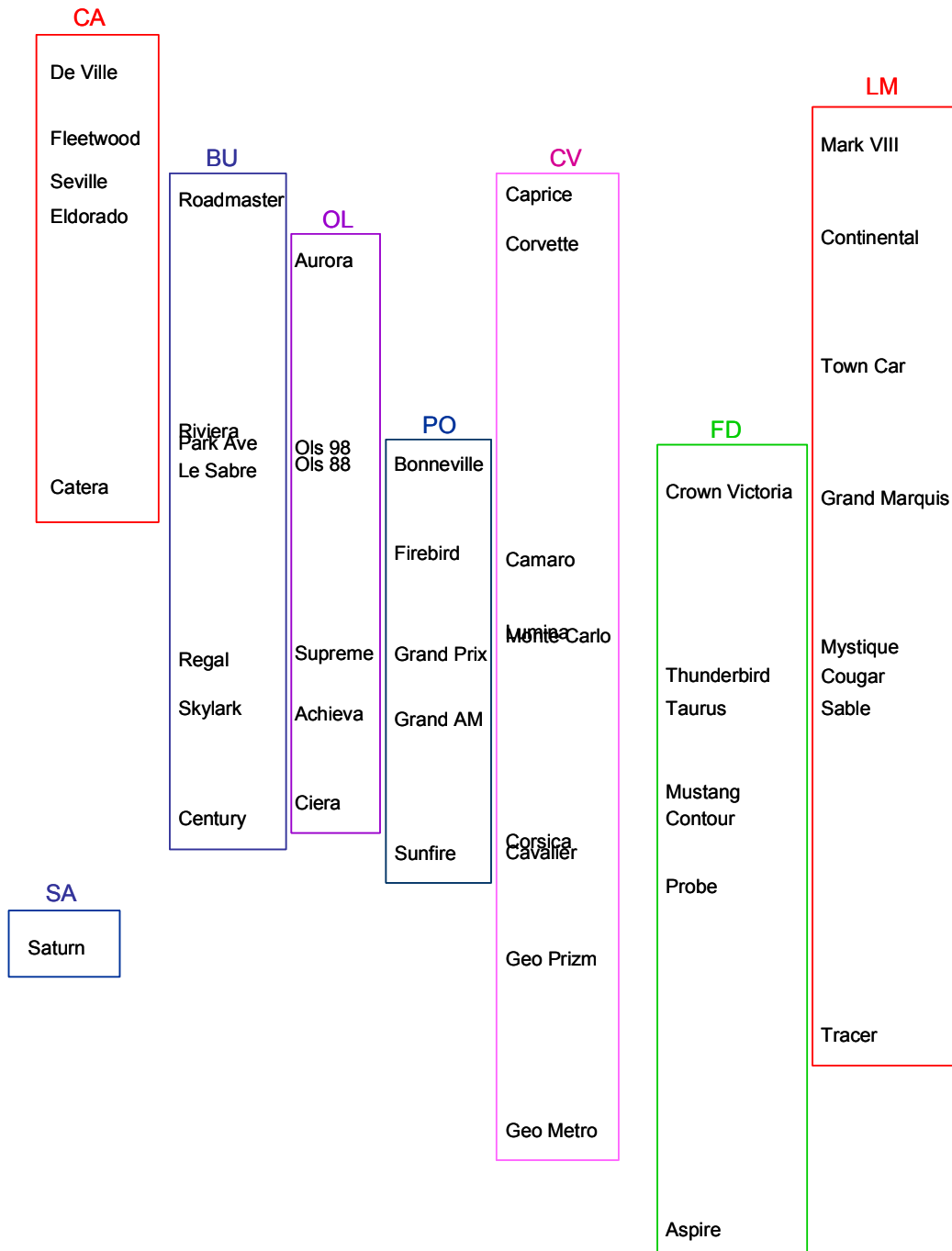


FIGURE 5.2
Utility Index: GM vs. Chrysler (1996)

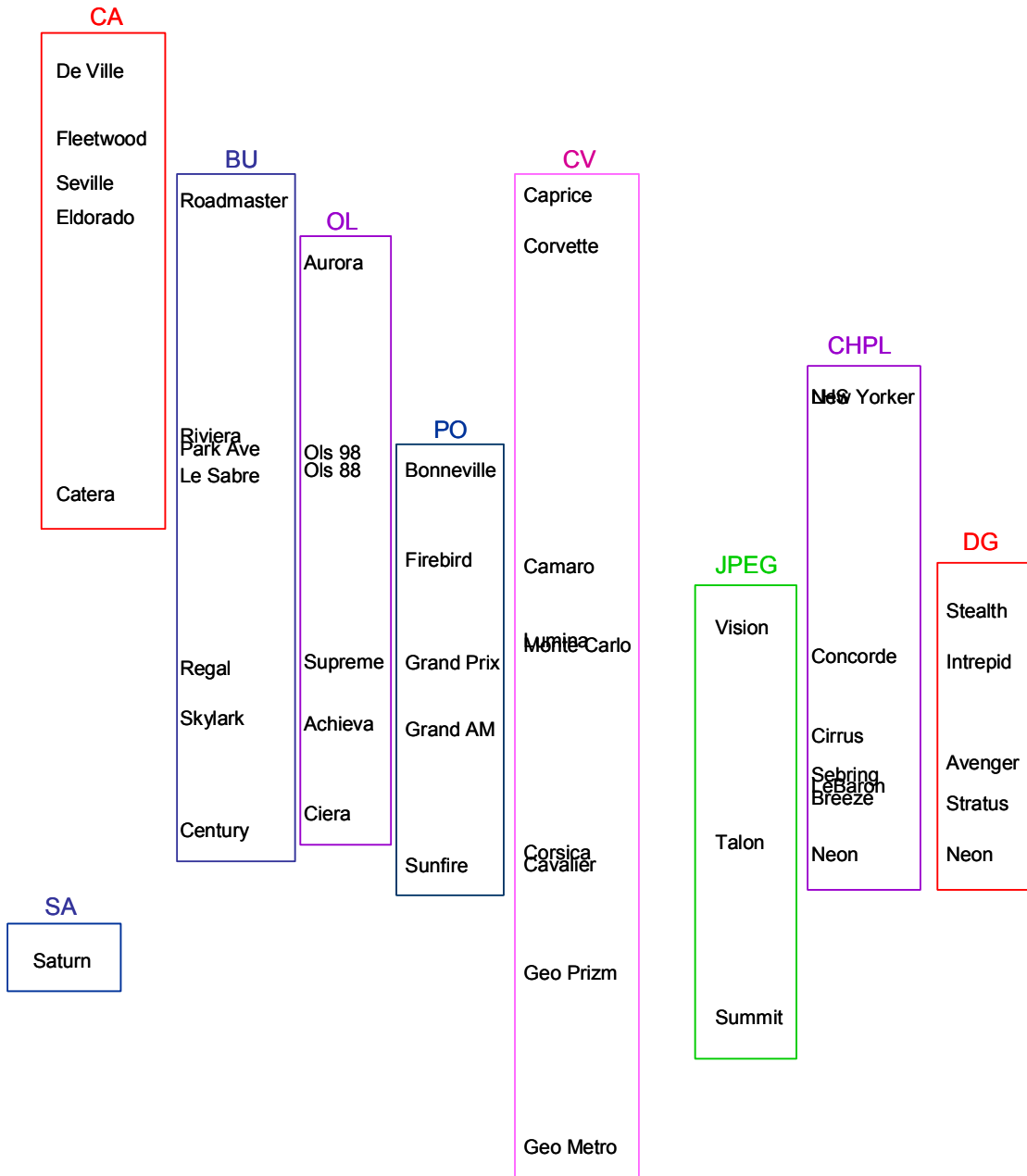


FIGURE 5.3
Utility Index: GM vs. Toyota vs. Honda (1996)

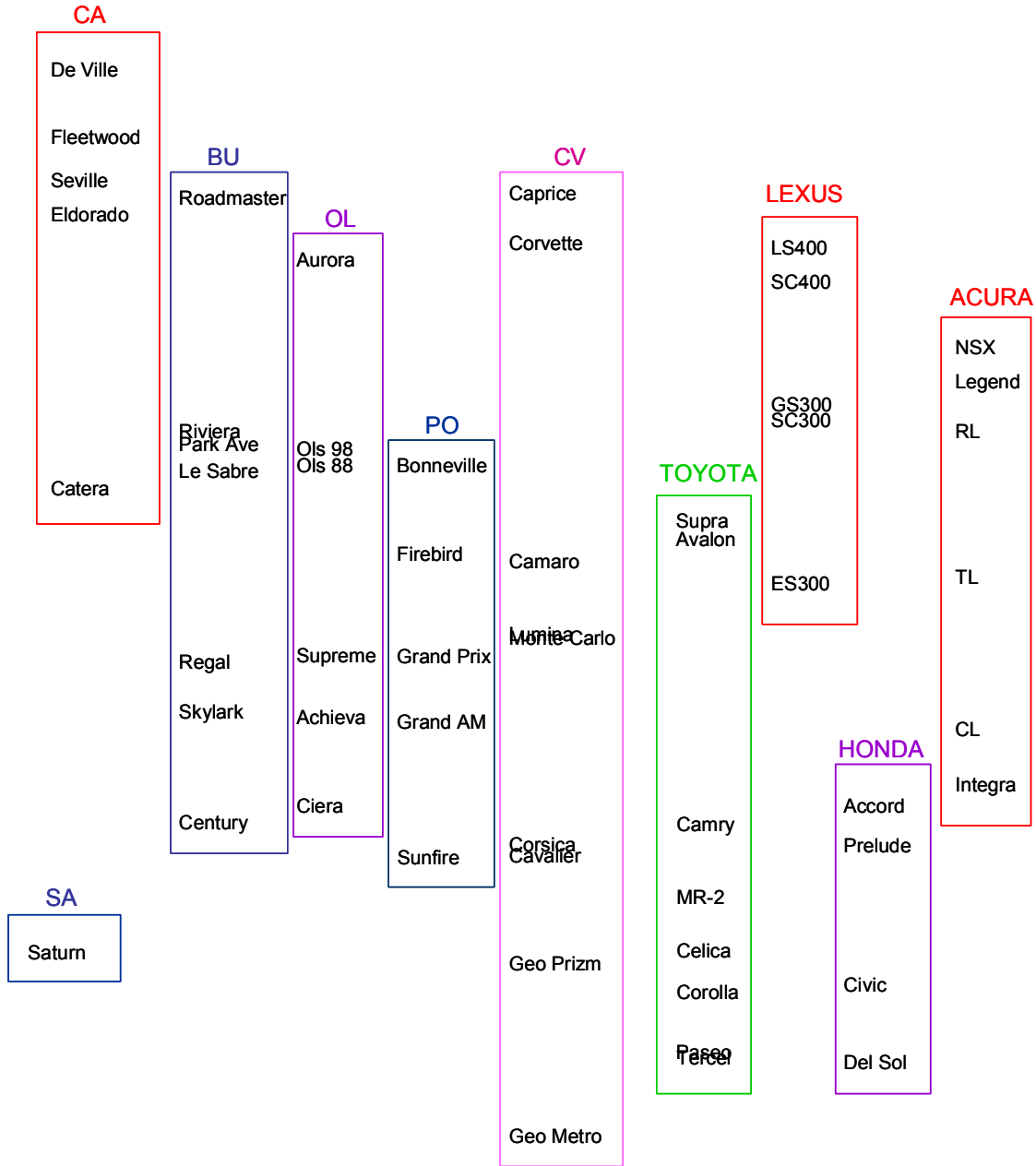


FIGURE 5.4
Utility Index: Chrysler vs. Ford vs. Toyota vs. Honda (1996)

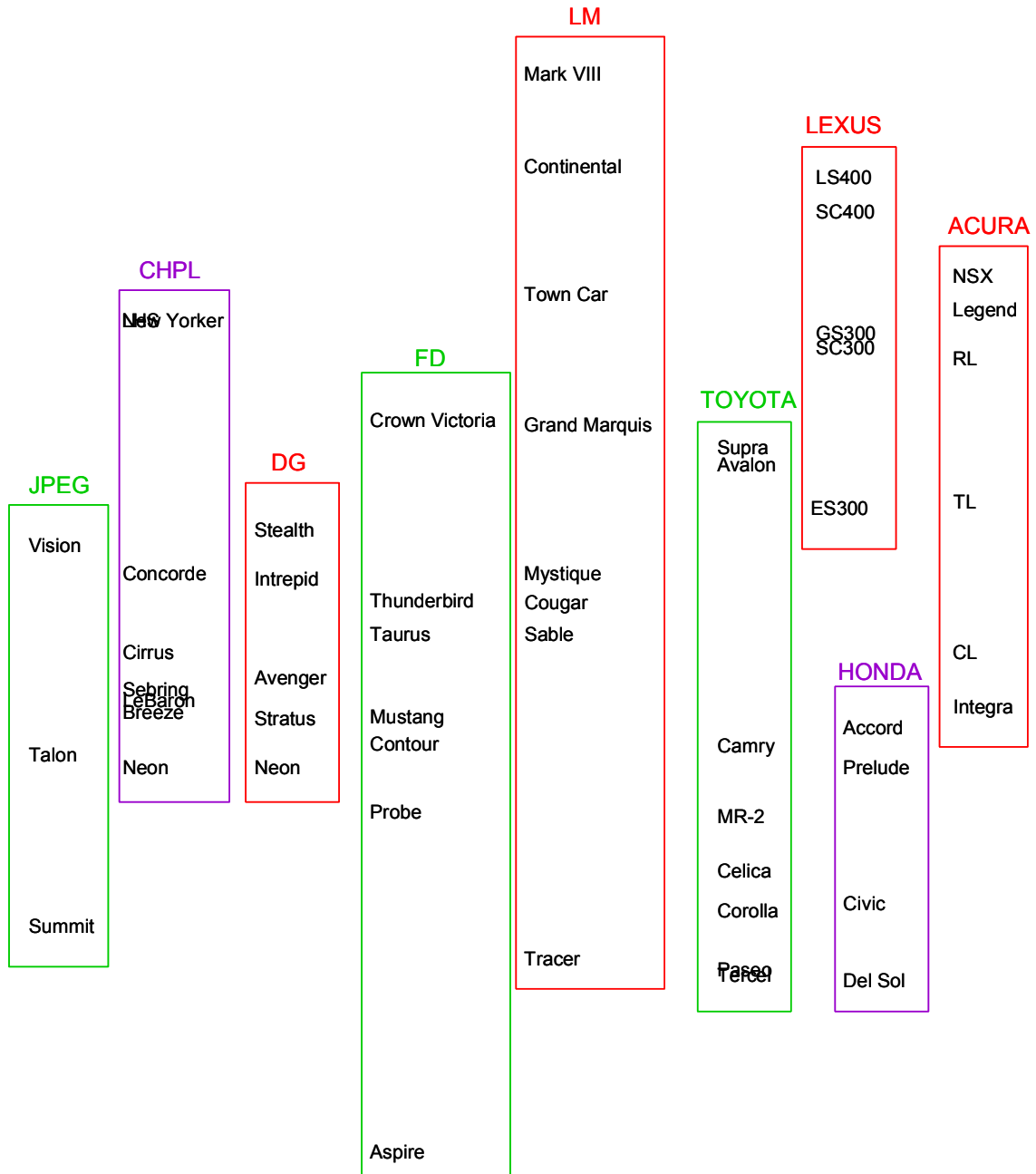
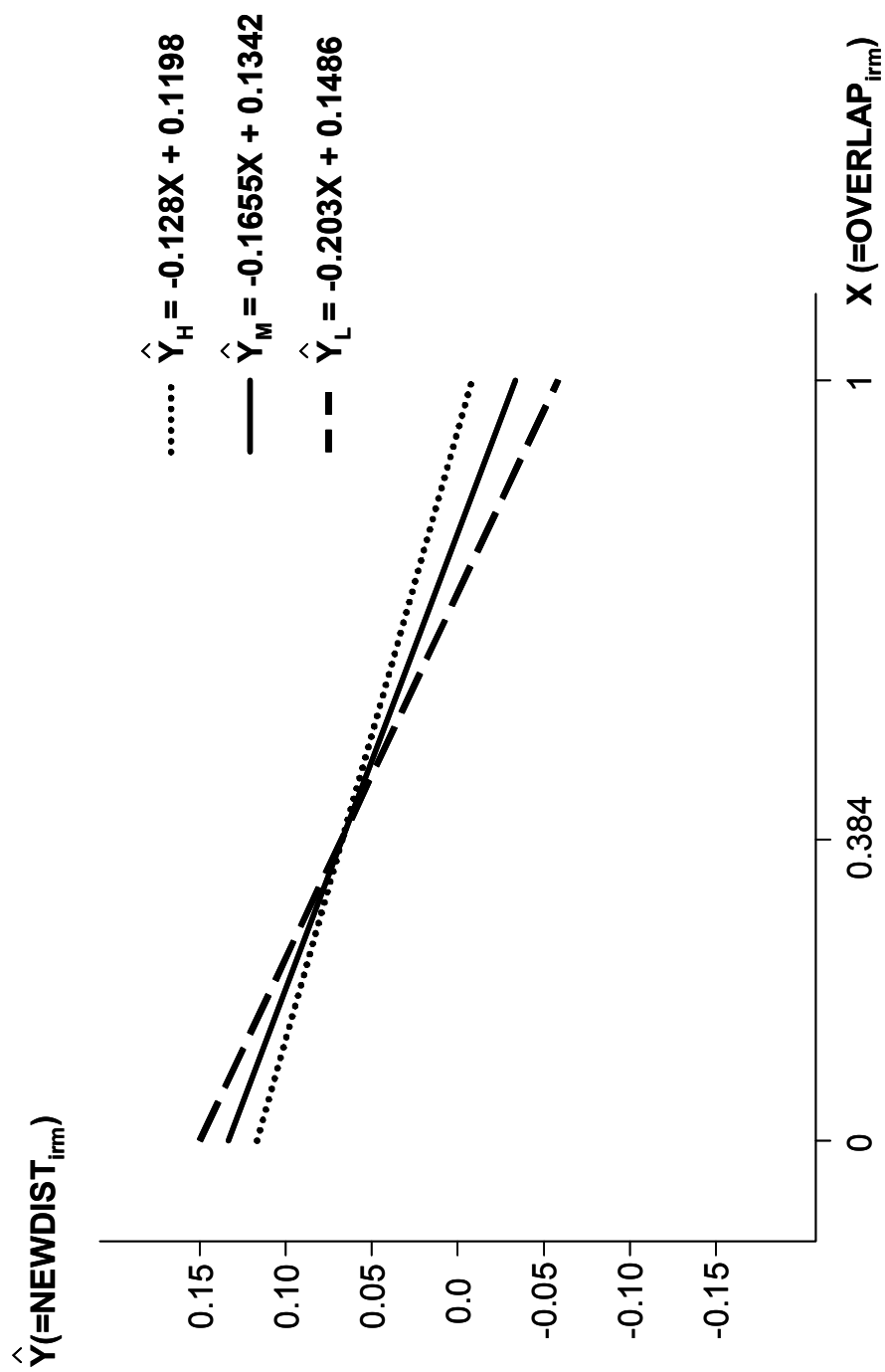


FIGURE 5.5
Moderating Effects of Divisional Density



APPENDIX B

TABLES

TABLE 1

Descriptive Statistics and Correlation Coefficients of Price and Product Attributes

Variables	N	Mean	SD	1	2	3	4	5	6	7
1 . Log Price (1983 Constant Dollar)	3379	9.42	0.59							
2 . Wheel Base ^a	3379	102.93	8.22	0.38 *						
3 . Length ^a	3379	182.68	16.63	0.41 *	0.82 *					
4 . Width ^a	3379	68.87	3.97	0.45 *	0.73 *	0.84 *				
5 . Horse Power	3379	134.37	57.33	0.84 *	0.39 *	0.44 *	0.56 *			
6 . Mile Per Gallon	3379	22.40	6.32	-0.57 *	-0.48 *	-0.62 *	-0.57 *	-0.61 *		
7 . Trend	3379	11.92	6.10	0.37 *	0.09 *	0.01	0.15 *	0.46 *	0.00	
8 . Market Share	3379	0.01	0.01	-0.33 *	0.10 *	0.11 *	0.09 *	-0.21 *	0.12 *	-0.05 *

* $p < .05$ ^a Unit: inch

TABLE 2
Results of Instrumental Variable (IV) Estimation

Independent Variables	<u>IV Estimation</u>		<u>OLS Estimation</u>	
	<u>Coff</u>	<u>Std Coeff</u>	<u>Coff</u>	<u>Std Coeff</u>
<u>Dependent Variable: Log(Price)</u>				
Intercept	7.7358 ** (0.174)		8.7603 ** (0.128)	
Wheel Base	0.0071 ** (0.001)	0.0982	7.7E-03 ** (0.001)	0.1067
Length	0.0064 ** (0.001)	0.1782	0.0032 ** (0.001)	0.0885
Width	-0.0121 ** (0.003)	-0.0807	-0.0229 ** (0.003)	-0.1534
Horse Power	0.0062 ** (0.000)	0.6037	0.0078 ** (0.000)	0.7516
Mile Per Gallon	-0.0015 (0.002)	-0.0162	-6.4E-03 ** (0.001)	-0.0682
Trend	0.0068 ** (0.001)	0.0697	3.4E-03 ** (0.001)	0.0351
Market Share	-41.0034 ** (2.158)	-0.5697	-11.71135 ** (0.672)	-0.1627
<i>Number of Observations</i>	3379		3379	
<i>F-value</i>	916 **		1396.05 **	
<i>R²</i>	0.60		0.74	
Hausman Test (Ho=No systematic difference)				
	$\chi^2 (6)$		203.93 **	

+ $p < .1$; * $p < .05$; ** $p < .01$

TABLE 3
Descriptive Statistics and Correlation Coefficients: Probit Estimation (Selection Equation)

Variables	N	Mean	SD	1	2	3	4	5
1 . New Product Introduction (1/0)	4996	0.03	0.18					
2 . Total No. of Products in Market (MKTPRODS)	4996	163.82	14.72	0.00				
3 . No. of Own Division's Products (DIVPRODS)	4996	8.44	3.04	0.00	0.06 *			
4 Division Size (DIVSIZE)	4996	12.88	1.02	-0.06 *	-0.12 *	0.46 *		
5 Firm Size (FIRM SIZE)	4996	13.99	0.94	-0.03 *	-0.09 *	0.20 *	0.73 *	
6 Fixed Cost (FIXCOST)	4996	743.41	203.65	-0.05 *	0.16 *	-0.22 *	-0.11 *	-0.10 *

* $p < .05$

TABLE 4
Results of Probit Estimation (Selection Equation)

Independent Variables	<u>Model</u>
<u>DV: New Product Introduction (1/0)</u>	
Intercept	0.3135 (0.673)
Total No. of Products in Market (MKTPRODS)	-0.0007 (0.002)
No. of Own Division's Products (DIVPRODS)	0.0339 (0.014) *
Division Size (DIVSIZE)	-0.2502 (0.057) **
Firm Size (FIRMSIZE)	0.0948 (0.056) +
Fixed Cost (FIXCOST)	-0.0006 (0.000) **
<i>Number of Observations</i>	4996
<i>Log Likelihood</i>	-698
<i>LR χ^2</i>	41 **
<i>Pesudo R²</i>	0.03

+ $p < .1$; * $p < .05$; ** $p < .01$

TABLE 5
Descriptive Statistics and Correlation Coefficients: Intra-divisional New Product Distance (im)

Variables	N	Mean	SD	1	2	3	4	5
1 Intra-division New Product Distance (NEWDIST _{im})	163	0.108	0.153					
2 . No. of Own Division's Products (DIVPRODS)	163	8.497	3.319	-0.48 *				
3 . No. of Other Divisions' Products (SISPRODS)	163	14.534	10.247	-0.07	0.12			
4 . No. of Rival Divisions' Products (RIVPRODS)	163	140.638	19.150	0.31 *	-0.40 *	-0.52 *		
5 Density of Division (DENSITY)	163	-0.348	0.132	-0.52 *	0.23 *	0.23 *	-0.31 *	
6 Trend (TREND)	163	10.945	5.777	0.14	-0.26 *	-0.12	0.55 *	-0.27 *
7 Inverse Mills ratio (LAMBDA)	163	2.180	0.210	-0.33 *	0.14	0.11	-0.10	0.02
8 Status of Division (STATUS)	163	0.393	0.214	-0.36 *	0.40 *	-0.54 *	0.10	0.10
9 . Competitive Uncertainty (COMPUN)	155	0.041	0.034	-0.06	0.18 *	0.80 *	-0.65 *	0.07
10 STATUS * COMPUN	155	-0.003	0.006	0.05	0.01	-0.43 *	0.34 *	-0.18 *

Variables	6	7	8	9
7 Inverse Mills ratio (LAMBDA)	0.41 *			
8 Status of Division (STATUS)	-0.03	0.46 *		
9 . Competitive Uncertainty (COMPUN)	-0.29 *	0.14	-0.41 *	
10 STATUS * COMPUN	0.05	-0.37 *	-0.08	-0.407 *

* $p < .05$

TABLE 6
Results of Car Model-specific Random-Effects GLS Estimation: Intra-divisional New Product Distance (im)

Independent Variables	Model 1	Model 2	Model 3.1	Model 3.2
DV: <i>NEWDIST_{im}</i>				
Intercept	0.5804 (0.099) **	0.6588 (0.152) **	0.3474 (0.169) *	0.3489 (0.170) *
No. of Own Division's Products (DIVPRODS)	-0.0146 (0.003) **	-0.0160 (0.004) **	-0.0116 (0.003) **	-0.0118 (0.004) **
No. of Other Divisions' Products (SISPRODS)	0.0020 (0.001) +	0.0028 (0.002) +	0.0036 (0.002) *	0.0037 (0.002) *
No. of Rival Divisions' Products (RIVPRODS)	0.0005 (0.001)	0.0003 (0.001)	-0.0002 (0.001)	-0.0003 (0.001)
Density of Division (DENSITY)	-0.5114 (0.071) **	-0.5230 (0.073) **	-0.3262 (0.078) **	-0.3245 (0.079) **
Trend (TREND)	0.0014 (0.002)	0.0023 (0.003)	0.0023 (0.003)	0.0023 (0.003)
Inverse Mills ratio (LAMBDA)	-0.2238 (0.051) **	-0.2640 (0.078) **	-0.1275 (0.086)	-0.1281 (0.086)
Status of Division (STATUS)			0.0663 (0.093)	0.0742 (0.104)
Competitive Uncertainty (COMPUN)			-0.5061 (0.486)	-0.4963 (0.491)
STATUS * COMPUN				0.3284 (1.888)
<i>Number of Observations</i>	163	163	155	155
<i>Wald χ^2</i>	156.28 **	156.2 **	44.73 **	44.46 **
<i>R²</i>	0.50	0.50	0.23	0.23

+ $p < .1$; * $p < .05$; ** $p < .01$

TABLE 7
Descriptive Statistics and Correlation Coefficients: Inter-Firm Divisional New Product Distance (irm)

Variables	N	Mean	SD	1	2	3	4
1 . Inter-firm New Product Distance (NEWDIST _{irm})	1780	0.155	0.200				
2 . No. of Own Division's Products (DIVPRODS)	1780	8.189	3.110	-0.17 *			
3 . No. of Other Divisions' Products (SISPRODS)	1780	13.475	9.743	-0.12 *	0.15 *		
4 No. of Rival Divisions' Products (RIVPRODS)	1780	144.878	17.877	0.12 *	-0.37 *	-0.51 *	
5 Trend (TREND)	1780	12.537	5.624	0.25 *	-0.29 *	-0.13 *	0.47 *
6 Inverse Mills ratio (LAMBDA)	1780	2.213	0.203	0.14 *	0.04	0.01	-0.02
7 Degree of Inter-firm Divisional Overlap (OVERLAP _{ir})	1780	0.332	0.319	-0.29 *	0.10 *	-0.07 *	-0.02
8 . Density of Division (DENSITY)	1780	-0.349	0.123	-0.18 *	0.11 *	0.23 *	-0.20 *
9 OVERLAP _{ir} * DENSITY	1780	0.005	0.041	0.00	0.00	-0.05 *	0.07 *

Variables	5	6	7	8
6 Inverse Mills ratio (LAMBDA)	0.46 *			
7 Degree of Inter-firm Divisional Overlap (OVERLAP _{ir})	-0.08 *	-0.088 *		
8 . Density of Division (DENSITY)	-0.32 *	-0.287 *	0.13 *	
9 OVERLAP _{ir} * DENSITY	-0.02	-0.033	0.15 *	-0.039

* $p < .05$

TABLE 8
Results of Car Model-specific Random-Effects GLS Estimation: Inter-Firm Divisional New Product Distance (irm)

Independent Variables	Model 4	Model 5	Model 6.1	Model 6.2
DV: $NEWDIST_{irm}$				
Intercept	-0.0436 (0.097)	0.0103 (0.094)	0.0495 (0.096)	0.0459 (0.096)
No. of Own Division's Products (DIVPRODS)	-0.0075 (0.003) **	-0.0057 (0.003) *	-0.0056 (0.003) *	-0.0057 (0.003) *
No. of Other Divisions' Products (SISPRODS)	-0.0021 (0.001) *	-0.0027 (0.001) **	-0.0024 (0.001) **	-0.0024 (0.001) **
No. of Rival Divisions' Products (RIVPRODS)	-0.0009 (0.001)	-0.0009 (0.001)	-0.0009 (0.001)	-0.0010 (0.001)
Trend (TREND)	0.0075 (0.002) **	0.0075 (0.002) **	0.0069 (0.002) **	0.0071 (0.002) **
Inverse Mills ratio (LAMBDA)	0.0465 (0.049)	0.0224 (0.047)	0.0077 (0.048)	0.0078 (0.048)
Degree of Inter-firm Divisional Overlap (OVERLAP _{it})	H3 (-)	-0.1615 (0.013) **	-0.1600 (0.013) **	-0.1655 (0.013) **
Density of Division (DENSITY)	H4 (-)	-0.1219 (0.068) +	-0.1219 (0.068) +	-0.1172 (0.068) +
OVERLAP _{it} * DENSITY			0.3046 (0.102) **	
<i>Number of Observations</i>	1780	1780	1780	1780
<i>Wald χ^2</i>	50.35 **	208.89 **	212.96 **	222.23 **
<i>R²</i>	0.08	0.15	0.16	0.16

+ $p < .1$; * $p < .05$; ** $p < .01$

TABLE 9
Descriptive Statistics and Correlation Coefficients: Intra-Firm Divisional New Product Distance (ijm)

Variables	N	Mean	SD	1	2	3	4	5
1 . Intra-firm New Product Distance (NEWDIST _{ijm})	297	0.146	0.215					
2 . No. of Own Division's Products (DIVPRODS)	297	8.667	2.935	-0.19 *				
3 . No. of Other Divisions' Products (SISPRODS)	297	22.000	10.885	-0.04	-0.11 *			
4 . No. of Rival Divisions' Products (RIVPRODS)	297	133.354	18.284	0.17 *	-0.13 *	-0.53 *		
5 Density of Division (DENSITY)	297	-0.326	0.115	-0.14 *	-0.14 *	0.20 *	-0.21 *	
6 Trend (TREND)	297	11.037	5.745	0.29 *	-0.27 *	-0.10	0.56 *	-0.16 *
7 Inverse Mills ratio (LAMBDA)	297	2.214	0.158	0.16 *	0.05	0.14 *	0.00	-0.28 *
8 . Degree of Intra-firm Divisional Overlap (OVERLAP _{ij})	297	0.345	0.304	-0.37 *	0.20 *	0.10	-0.13 *	0.15 *
9 Status of Division (STATUS)	297	0.311	0.184	-0.02	0.44 *	-0.72 *	0.30 *	-0.21 *
10 OVERLAP _{ij} * STATUS	297	-0.008	0.065	0.20 *	-0.01	0.06	-0.09	-0.09
11 Cooperation-oriented Compensation (EXECCOMP)	250	0.333	0.115	0.17 *	-0.07	0.13 *	0.36 *	0.04
12 OVERLAP _{ij} * EXECCOMP	250	0.000	0.035	-0.18 *	0.09	-0.03	-0.10	-0.06
13 Status Difference (STATUSDIFF)	297	-0.005	0.253	-0.04	-0.44 *	0.01	0.09	0.07

Variables	6	7	8	9	10	11	12
7 Inverse Mills ratio (LAMBDA)	0.46 *						
8 . Degree of Intra-firm Divisional Overlap (OVERLAP _{ij})	-0.10	-0.07					
9 Status of Division (STATUS)	-0.05	0.24 *	-0.15 *				
10 OVERLAP _{ij} * STATUS	-0.04	-0.09	-0.63 *	-0.10			
11 Cooperation-oriented Compensation (EXECCOMP)	0.58 *	0.19 *	0.00	-0.057	0.06		
12 OVERLAP _{ij} * EXECCOMP	-0.04	0.05	0.17 *	0.077	-0.13 *	0.03	
13 Status Difference (STATUSDIFF)	0.02	-0.53 *	0.29 *	-0.612 *	0.05	-0.05	-0.03

* $p < .05$

TABLE 10
Results of Car Model-specific Random-Effects GLS Estimation: Intra-Firm Divisional New Product Distance (ijm)

Independent Variables	Model 7	Model 8	Model 9.1	Model 9.2
DV: $NEWDIST_{ijm}$				
Intercept	0.0105 (0.212)	0.0792 (0.207)	-0.2205 (0.312)	-0.2250 (0.313)
No. of Own Division's Products (DIVPRODS)	-0.0122 (0.005) *	-0.0069 (0.005)	-0.0023 (0.006)	-0.0018 (0.007)
No. of Other Divisions' Products (SISPRODS)	-0.0010 (0.002)	-0.0007 (0.002)	-0.0035 (0.003)	-0.0036 (0.003)
No. of Rival Divisions' Products (RIVPRODS)	-0.0004 (0.001)	-0.0009 (0.001)	-0.0005 (0.001)	-0.0005 (0.001)
Density of Division (DENSITY)	-0.2004 (0.131)	-0.1041 (0.131)	-0.0492 (0.138)	-0.0495 (0.138)
Trend (TREND)	0.0094 (0.004) *	0.0102 (0.004) **	0.0073 (0.004)	0.0072 (0.004)
Inverse Mills ratio (LAMBDA)	0.0179 (0.106)	-0.0209 (0.103)	0.1307 (0.157)	0.1329 (0.157)
Degree of Intra-firm Divisional Overlap (OVERLAP _{ij})		-0.2379 (0.037) **	-0.2509 (0.038) **	-0.2588 (0.057) **
Status of Division (STATUS)				-0.2410 (0.189)
OVERLAP _{ij} * STATUS				-0.0477 (0.252)
Cooperation-oriented Compensation (EXECCOMP)				
OVERLAP _{ij} * EXECCOMP				
Status Difference (STATUSDIFF)				
<i>Number of Observations</i>	297	297	297	297
<i>Wald χ^2</i>	31.8 **	76.61 **	78.44 **	78.22 **
<i>R²</i>	0.11	0.20	0.21	0.21

+ $p < .1$; * $p < .05$; ** $p < .01$

TABLE 10
Continued

Independent Variables	Model 10.1	Model 10.2	Model 11	Model 12
DV: $NEWDIST_{it}$				
Intercept	-0.0819 (0.240)	-0.1136 (0.239)	0.5290 (0.277) +	-0.3808 (0.287)
No. of Own Division's Products (DIVPRODS)	0.0013 (0.005)	0.0020 (0.005)	-0.0191 (0.006) **	0.0052 (0.006)
No. of Other Divisions' Products (SISPRODS)	0.0040 (0.002) **	0.0040 (0.002) *	-0.0009 (0.002)	-0.0039 (0.003)
No. of Rival Divisions' Products (RIVPRODS)	0.0004 (0.001)	0.0001 (0.001)	-0.0009 (0.001)	0.0011 (0.001)
Density of Division (DENSITY)	-0.0721 (0.119)	-0.0883 (0.119)	-0.2836 (0.138) *	-0.0925 (0.119)
Trend (TREND)	0.0035 (0.004)	0.0035 (0.004)	0.0127 (0.004) **	-0.0030 (0.005)
Inverse Mills ratio (LAMBDA)	0.0613 (0.118)	0.0739 (0.117)	-0.2344 (0.136) +	0.2275 (0.146)
Degree of Intra-firm Divisional Overlap (OVERLAP _{ij})	-0.2014 (0.038) **	-0.1849 (0.039) **		-0.0600 (0.091)
Status of Division (STATUS)				-0.7126 (0.248) **
OVERLAP _{ij} * STATUS				0.5507 (0.336)
Cooperation-oriented Compensation (EXECCOMP)	0.1122 (0.125)	0.134402 (0.124)		0.2208 (0.138)
OVERLAP _{ij} * EXECCOMP		-0.711721 (0.323) *		-0.6537 (0.321) *
Status Difference (STATUSDIFF)			-0.1992 (0.068) **	-0.2657 (0.130) *
<i>Number of Observations</i>	250	250	297	250
<i>Wald χ^2</i>	59.47 *	65.29 **	39.89 **	76.5 **
<i>R²</i>	0.20	0.21	0.12	0.24

+ $p < .1$; * $p < .05$; ** $p < .01$

VITA

Eui Jeong

FULL LEGAL NAME

Eui Kyo Jeong

PERMANENT ADDRESS

1624 Clough St., #24
Bowling Green, OH 43402
U.S.A.

EDUCATION

Ph.D. (2003) Texas A&M University
Major area: Strategic Management
M.B.A (1996) Seoul National University, Seoul, Korea
B.B.A (1992) Seoul National University, Seoul, Korea

ACADEMIC EMPLOYMENT

2003 – Present	Assistant Professor Department of Management Bowling Green State University Bowling Green, OH 43403
2002 – 2003	Visiting Assistant Professor Department of Management University of Central Florida Orlando, FL 32816