



McCOMBS SCHOOL OF BUSINESS
The University of Texas at Austin

Herb Kelleher Center for Entrepreneurship

Working Paper Series Number 4

**WITHIN-BUSINESS DIVERSIFICATION IN TECHNOLOGY-INTENSIVE
INDUSTRIES**

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July 25, 2002

We are indebted to Marc-David Seidel, James Fredrickson, and seminar participants at the University of Texas at Austin and the Hebrew University of Jerusalem for their valuable comments and suggestions on earlier drafts of this paper.

ABSTRACT

Within-Business Diversification in Technology-Intensive Industries

This study extends diversification research to a new level of analysis, examining how within-business diversification, which occurs when firms extend existing product lines or expand into new ones, affects organizational survival. While prior research has concluded that corporate-level diversification has weak performance effects, we contend that diversification matters a great deal within businesses because it influences which startups survive and evolve into more mature organizations. We further contend that prior studies, by treating firms as independent, atomistic entities, have overlooked technological and competitive changes that occur when numerous firms diversify simultaneously, actions that we found to moderate the relationship between diversity and performance. Analysis of the population of U.S. personal computer manufacturers from 1975 through 1994 validates these premises.

The link between corporate diversification and firm performance is one of the most widely researched in strategy, and there is broad theoretical agreement that related diversification increases performance, while unrelated diversification decreases it. Related diversification, it is argued, enables a firm to leverage its resources by sharing knowledge and assets across businesses, yielding economies of scale and scope (Hill, Hitt, & Hoskisson, 1992; Markides & Williamson, 1994). Conversely, unrelated diversification is thought to decrease performance because it takes firms into unfamiliar settings where they lack expertise, encouraging an arms-length financial control mentality among top managers rather than a deep understanding of customers, operations, and competitors (Kogut & Zander, 1992; Hoskisson & Johnson, 1992).

While many researchers ascribe to these arguments, the diversification literature contains two troubling counterpoints. First, its empirical record is quite mixed. Some studies have found that related diversifiers outperform unrelated ones (e.g., Lubatkin & Rogers, 1989; Singh & Montgomery, 1987; Varadarajan & Ramanujam, 1987), yet others find the opposite, or report null results (e.g., Chatterjee, 1986; Lubatkin, 1987; Michel & Shaked, 1984).

Second, and perhaps more troubling, there is mounting evidence that corporate-level effects, which include the policies and skills that guide multibusiness diversification, account for relatively little variation in performance. Studies assessing the performance impact of business-unit conduct, industry structure, and corporate conduct have found that business-level effects are the largest by far (Brush, Bromiley, & Hendrickx, 1999; McGahan & Porter, 1997; Roquebert, Phillips, & Westfall, 1996). For example, Rumelt (1991) reported that business-unit effects explained 44 to 46 percent of the total variation in performance, while industry effects accounted for 9 to 16 percent, and corporate effects explained only 1 to 2

percent. So despite the appeal of the underlying theory, strong and consistent support for the benefits of relatedness is lacking.

In this study, we argue that such findings are neither evidence of unsound theory nor proof that diversification matters little. Diversification is traditionally viewed as a cross-industry phenomenon studied at the corporate level, and prior work has asked: How does diversifying across businesses and industries affect corporate performance? Firms, however, diversify not only across businesses, but also within them, which occurs when they extend existing product lines or expand into new ones. As we explain, there is good reason to believe that diversification matters a great deal within businesses regardless of its effects across them. That leads us to ask: How does diversifying within and across product lines affect business-level outcomes?

In addition to our level of analysis, we depart from prior work on diversification in two ways. One, prior studies have tended to treat firms as independent, atomistic entities whose performance depends heavily on how they utilize their own resources, but little on the actions of others (e.g., Rumelt, 1974, 1982). In comparison, we contend that the viability of a firm's diversification efforts is contingent on the level of environmental change wrought by its competitors who are simultaneously diversifying their own product portfolios. Thus, we emphasize how external change affects the value of diversifying¹.

Second, prior research has focused on samples of large, old, and publicly traded firms, which were drawn mostly from COMPUTSTAT (e.g., McGahan & Porter, 1997; Roquebert, Phillips, & Westfall, 1996) or the Federal Trade Commission (FTC) line of business database

¹ Others have studied how competitive interactions affect firms' decisions to enter new markets, but that work has focused on mutual forbearance between dyadic competitors (Baum & Korn, 1996; Baum, Korn, & Helaine, 1999; Haveman, 2000). Rather than concentrating on market entry, we extend such thinking by examining how competition among numerous firms affects the value of a diversified product portfolio.

(e.g., Rumelt, 1991). Those databases are composed of publicly traded firms that are large, old, and substantially diversified, and such restriction is likely to create sample selection and survivor biases (Heckman, 1979) because it ignores the fate of the many small and young companies that attempted to become large by diversifying but failed entirely. Such biases may be severe because 50% to 70% of new firms fail within their first 5 years and over 80% in their first decade (Aldrich & Auster, 1986). Since industries typically come to be dominated by a few large institutions that survive where many others have tried and failed (Barnett, 1997), prior work has limited its attention to the atypical and exceptional survivors of long-term selection processes. Consequently, the small corporate effects reported previously may not imply that diversification is unimportant, but that most of the large and old survivors in COMPUSTAT cleared a common threshold in their ability to diversify.

Since we believe that diversifying greatly influences survival even if its effects on the subsequent profitability of large corporations is modest, we are less interested in this study in what happens after an atypical survivor makes it into COMPUSTAT and more concerned about the evolutionary selection processes that precede and produce those rare outcomes. Thus, we consider the role that within-business diversification plays in determining which firms survive and fail as they attempt to evolve from small, insecure startups into more mature and diversified organizations. To do so, we further depart from earlier work by gauging the effects of within-business diversification on an entire population of firms, including many young and small ones.

WITHIN-BUSINESS DIVERSIFICATION

Firms vary widely in the diversity of products that they offer within a single industry. Compare, for example, Honda's and General Motors' within-business diversification in the

automobile industry (SIC = 3711), which involves passenger cars and light trucks. As Table 1 shows, GM manufactures 62 different autos grouped in 11 product lines, while Honda offers 16 autos in 2 lines. If many firms, like GM and Honda, differ substantially in their within-business diversity, what implications does that have for the diversification-performance linkage?

Insert Table 1 about here

This section develops two ideas. One, we provide a theoretical explanation for why diversification is likely to have profound effects on business-unit performance even if its effects are modest at the corporate level. Two, we argue that gauging within-business diversity is not simply a matter of counting products, but of understanding the structure of a firm's product lines, which points to political and technological relationships among a business' subunits.

Resource sharing within businesses. In arguing that related diversification allows resource sharing across distinctly different businesses, corporate-level studies have implicitly assumed that key technologies and routines have a modular quality that allows them to be plugged into new settings without drastic modification. That assumes, though, that a given skill or technology can be replicated with little regard to its organizational and environmental context, an idea that other research casts doubt on, especially in technology-intensive settings.

Studies of technological evolution reveal that the ability to construct, apply, and improve complex technologies is highly context-specific (Christensen, 1997; Henderson & Clark, 1990). One reason is that a firm's external surroundings critically influence its

knowledge development and information-processing (Lawrence & Lorsch, 1967), to the point that environments imprint organizations at birth and other major turning points (Stinchcombe, 1965; Tushman & Romanelli, 1985). That happens because the environment is a critical source of problems that drive organizational search and change (Cyert & March, 1963), and selection processes favor firms whose internal routines develop a close match with the demands of their chosen niche (Hannan & Carroll, 1992). Organizational knowledge is therefore shaped by the environment and applied in response to it.

Effectively transferring knowledge between two businesses is unlikely, then, unless their external environments are similar. Without the proper external stimuli to drive information search and retrieval, the source business will often fail to recall that fact X is vital to the application of technology Y, a likely occurrence in technology-intensive settings where tacit knowledge is pervasive (Dosi, 1988; Nelson & Winter, 1982). For example, consider the challenges one faces in learning a new statistics program. You could ask a colleague for advice, but even if she were quite knowledgeable, she probably could not provide the necessary information unless (a) you knew precisely what problem you wanted to solve (e.g., discrete-time event history analysis), (b) your friend had solved a similar problem before, and (c) she had an example of the program code you needed. Much of what your friend knows is tacit in nature, partially forgotten since she learned it, and embedded in specific pieces of software that she has written and debugged through trial and error, software that only she can decipher, if she is prompted by the right stimulus. Therefore, unless you and your colleague faced a similar external stimulus, you would have difficulties learning from her since you would be unable to ask appropriate questions, and she would have difficulty revealing all that she knew. Accordingly, since industry environments vary greatly in their dynamism,

customer characteristics, competitiveness, and overall pace (Dess & Beard, 1984), valuable information transfers in multibusiness corporations are unlikely even if knowledge sharing is technically feasible.

A second reason that learning about complex technologies is context-dependent is that such knowledge is often embedded in a firm's problem-solving strategies, communication channels, and the filters it uses to sift and prioritize incoming data (Henderson & Clark, 1990; Nelson & Winter, 1982). Since those are core structural features of an organization, they are durable, inertial, and difficult to change (Hannan & Freeman, 1984; Nelson & Winter, 1982). And across time, problem-solving techniques, communication channels, and information filters, like other core elements, become implicit, taken-for-granted, and invoked more or less automatically in response to specific stimuli (Henderson & Clark, 1990).

Because of that, effectively transferring resources across businesses is unlikely unless they are structurally similar. Without such similarity, the receiving business would lack: (1) the communication channels and information filters needed to receive rich information, (2) the organizational subunits and routines needed to store it, and (3) the implicit problem-solving strategies needed to invoke and utilize it. Even if a firm's managers were aware of mismatches between businesses, their ability to redesign subunits to achieve structural congruence would be limited due to the inertial nature of core features, particularly those that support an organization's key technologies (Christensen, 1997; Hannan & Freeman, 1984; Tushman & Anderson, 1986).

Overall, unless two businesses in a diversified firm have highly similar external environments and comparable internal structures, effective technology transfers between them are unlikely. Much of what the source business knows is tacit, organizationally embedded,

and automatically invoked by specific environmental stimuli rather than deliberate decisions, so it has a difficult time transmitting its expertise. And if the source business somehow overcame those barriers, the receiving business would lack the structures and routines needed to store the incoming data. Importantly, contextual mismatches between source and recipient units are likely to be the norm in multibusiness firms because that is precisely how dividing lines among businesses are set (Chandler, 1962). Businesses that face different task environments or require different problem-solving approaches are usually separated into semi-autonomous business units (Palmer et al., 1987). Subsequently, that separation and dissimilarity breeds competition, conflict, and self-interested political bargaining among them rather than the ongoing, face-to-face interaction needed to transfer embedded knowledge (cf. Hansen, 1999; Palich et al., 2000).

In comparison, environmental and structural similarity are more likely inside businesses, and especially within product lines. Products in the same line are often designed and manufactured by overlapping teams at the same location, use the same technologies to satisfy similar needs, and are marketed to comparable customers through common channels (Kotler, 2000). Sharing expertise, fixed assets, and capabilities within product lines is quite feasible because physical proximity, shared language, task similarity, and face-to-face communications among individuals and teams encourage the transfer and retention of complex, tacit knowledge (cf. Luke et al., 1989; Monge, Rothman, Eisenberg, Miller, and Kirste, 1985). Returning to our earlier example, Honda Accords and Civics are members of the same product line and share components, manufacturing facilities, personnel, advertising efforts, dealerships, and so forth. And since those products serve the same mid-range market segment and have structurally similar organizations, resource transfers between the Honda

and Civic subgroups are intense and effective (Mair, 1994). Consequently, even if corporate-level resource sharing is modest in frequency or impact (e.g., between Honda's auto and lawnmower businesses), transfers within product lines have the potential to strongly affect performance because similarity in subgroups' task environments, structures, and routines enables efficient transfers of complex and valuable information.

Though finer-grained, the arguments above offer similar conclusions to existing theory -- resource transfers are easier when subunits are more related. Thus, the payoff to our ideas comes not from thinking about relatedness in isolation, but in deciding how distinctive two activities have to be before they become unrelated. Prior work has assumed that resources are fairly mobile across 4-digit SIC codes. More importantly, prior research has assumed, for example, that because the Honda and Acura product lines lie within the same 4-digit industry, resource transfers between those subunits are so seamless that they can be treated as a single, homogenous entity. In comparison, we assert that resources are much less mobile than that in technology-intensive settings, to the extent that knowledge transfers across product lines have a distinctly different character than those among products within the same line. The following section pursues this idea, and as before, we emphasize that effective knowledge transfers require similarity in subunits' environmental and organizational contexts.

Product-line structure. Outside the corporate diversification literature, several studies have considered how many products a company should produce. Sorenson (2000), for example, investigated how multiple product offerings affect firm viability, and Kekre and Srinivasan (1990) studied the relationship between product variety and firm profitability. Likewise, in examining mortality rates under various environmental conditions, ecologists have distinguished between specialist organizations, who offer a limited number of products,

and generalists, who offer a broad range (Freeman, and Hannan, 1983; Dobrev, Kim, and Hannan, 2001). While informative, such analyses have overlooked how a firm's products are structured into lines, which provides important information about (a) the variety of market segments targeted, and (b) political relationships among the subunits within a business, each of which is responsible for a different product line.

Serving different segments often requires different technologies and capabilities (Collis & Montgomery, 1997). Consequently, firms frequently break up their product portfolios into different lines and groups, each tailored to a specific segment. Honda Motor Co., for instance, has been marketing mid-range, fuel-efficient cars, such as the Accord and Civic, in the United States since 1969. But when Honda entered the luxury automobile market in 1986 with its Acura line, it did so by setting up a new division with a separate dealer network, believing that a distinct Acura organization would help to build the appeal needed to sell luxury performance cars (Shook, 1988). Yet as Tetsuo Chino, American Honda's president at the time explained, that decision went well beyond image building. Honda believed the two markets were significantly different, and hence, wanted each of its divisions to focus and specialize within its own niche and have the freedom to pursue its own designs and technologies (Toy, 1986). Thus, the differences in customers and technologies that corporate strategy researchers assume to exist across businesses may also be highly relevant across product lines within businesses.

Product line distinctions are also important politically. By its nature, a diversified business comprises several subunits that are likely to be unequally powerful (Tushman, 1977). At any point in time, one subunit is more dominant than others because it is responsible for the firm's primary product line, which most profoundly embodies the organization's core

skills and resources. Therefore, the unit responsible for the firm's primary line has a vested interest in the firm's current technology and practice, and since it wants to retain that power, it will strive to protect and reinforce the organizational status quo (Pfeffer & Salancik, 1978). Diversification within the primary product line is likely, then, to exploit established practices and be highly related to the existing products, technologies, and routines that define the status quo (cf. March, 1991). In contrast, more exploratory and less related practices will tend to be introduced by non-central subgroups, since they have less of a vested stake in existing arrangements (Leblebici, Salancik, Copay, & King, 1991). For example, exploration of the no-haggle sales approach within General Motors was led by its newly formed Saturn product line, not one of its established lines such as Chevrolet or Buick.

Recap. On the whole, sharing resources across lines is more difficult than among products within a line. Products in the same line are often manufactured by the same people in the same location, satisfy similar needs, use the same technologies, and target similar customers. Thus, persons working on products in the same line respond to the same external stimuli, invoke similar routines and problem-solving approaches, and interact regularly, face-to-face. As argued earlier, those features enable the transfer of complex, tacit, and organizationally-embedded information. In comparison, persons working on different lines typically reside in different groups and locations, and address different customer needs using distinct technologies, so transfers of tacit knowledge are much less frequent and effective.

Additionally, the group backing a firm's primary product line wields much political power and works to bolster it by exploiting well-understood approaches that reinforce the status quo. Therefore, diversification within a firm's primary line tends to be highly related and exploitative, while expansions outside it tend to be less related and more exploratory.

Accordingly, in the rest of the paper, we tap into the distinction between exploration and exploitation by distinguishing between diversification inside and outside a firm's primary product line, and the term *related diversification* denotes expansions within a firm's primary product line, while *less related diversification* denotes expansions outside it.

HYPOTHESES

Our first hypotheses consider how the existing level of diversity in a firm's primary product line affects its future viability, and we argue that relationship is contingent on the level of competitive and technological change in the external environment. In more stable settings, primary-line diversification helps firms to build and exploit highly specialized and well-rehearsed routines, which enhances reliability and competence, and improves the odds of surviving (cf. Hannan & Freeman, 1984, 1989; March, 1991). Since the products in a firm's primary line often share components, production technologies, distribution channels, and customers, a highly diversified line also reduces overall cost and better tailors products to fit customers' needs (Kotler, 1997). In addition, mastering new developments in technology-intensive settings often requires substantial familiarity with existing approaches (Cohen & Levinthal, 1990; Dosi, 1988), and larger and more diverse primary line is likely to establish such familiarity.

While related diversification increases organizational viability in more stable settings, it becomes a liability in more dynamic ones. Resource sharing reduces costs, and it may speed the repetition of today's tasks, yet it also creates operating interdependencies that impede a firm's ability to respond to external developments. Changes to one product necessitate changes to others, and such alterations are time consuming and costly to coordinate (Davis et al., 1992; Jones & Hill, 1988). Attempted responses to external change

also generate political resistance by dominant subgroups since they are so invested in existing organizational arrangements (Pfeffer & Salancik, 1978). As noted above, the subgroup backing a firm's primary line is likely to be politically dominant since it controls vital resources, and we further surmise that such groups are especially powerful in firms with highly diversified primary lines that command extensive human and financial capital. Consequently, firms with diverse primary lines have numerous interdependencies to manage and a dominant subgroup that is wary of change. As the level of environmental flux increases, change costs increase rapidly in such firms, and they are likely to respond slowly to external developments. In turn, that increases their risks of obsolescence and organizational failure (cf. Barron, West, & Hannan 1994).

In technology-intensive settings, new product introductions are often the primary vehicle of innovation, technological change, and competitive thrusts (Drazin & Rao, 2002; Eisenhardt & Tabrizi, 1995; Tushman & Anderson, 1986). Consequently, the aggregate number of new product introductions by the other organizations in a focal firm's industry serves as a strong proxy for the level of competitive and technological change in its environment. Coupled with our arguments above, this suggests:

Hypothesis 1a: *When the aggregate number of new product introductions by competitors is relatively low, a firm's future likelihood of failure will decrease with the current level of diversification in its primary product line.*

Hypothesis 1b: *When the aggregate number of new product introductions by competitors is relatively high, a firm's future likelihood of failure will increase with the current level of diversification in its primary product line.*

The foregoing discussion considers the present diversity of a firm's product portfolio, portions of which are likely to have been introduced at various times in its past. Another aspect of diversification, though, involves a firm's attempts to change its diversity by developing new products, a critical means of organizational adaptation (Brown & Eisenhardt, 1995; Eisenhardt & Tabrizi, 1995). Importantly, new products do not all contribute equally to change efforts, since a product may be more or less related to a firm's existing skill set.

Additions to a firm's primary product line represent development efforts that are highly related to established activities. In a relatively stable environment, such additions are more reliable and efficient than creating new products from a blank slate because (a) existing building blocks can be reused to construct new solutions, and (b) firms can draw on related efforts to form better inferences about causal relationships between their actions and the environment's responses (Levinthal, 1991; Lindblom, 1959).

While related diversification of this sort offers certain benefits, it constrains the amount of change that new products embody because a firm's primary line is backed by a politically powerful subgroup that is wedded to exploiting the status quo, and disinclined to take risks or explore new approaches (Kahneman & Tversky, 1979; March, 1991). If the environment is characterized by high levels of competitive and technological change, then diversifying by investing in new but highly incremental products may represent an ill-advised, overly bureaucratic, and insufficiently aggressive response to markedly changed conditions (cf. Eisenhardt, 1989; Tushman & Romanelli, 1985). We predict, then, that the effect of diversifying via new product introductions in a firm's primary line is contingent on the level of environmental change, as captured by the aggregate number of competitors' new product introductions:

Hypothesis 2a: *When the aggregate number of new product introductions by competitors is relatively low, a firm's likelihood of failure will decrease with the number new product introductions in its primary product line.*

Hypothesis 2b: *When the aggregate number of new product introductions by competitors is relatively high, a firm's likelihood of failure will increase with the number new product introductions in its primary product line.*

Firms, of course, can introduce new products either inside or outside their primary line, so the question arises, which option is more beneficial? As argued above, primary-line introductions embody incremental refinements that draw heavily on the firm's most established resources. Conversely, introductions outside the primary line tend to be carried out by more peripheral and less dominant subgroups who are more likely to experiment with new approaches (Leblebici et al., 1991). As March (1991) details, exploring new technologies and routines is more costly and uncertain than exploiting well worn methods, yet exploration is vital to survival when a firm is faced with high levels of external change that threaten its established skills with obsolescence. We predict, then, that the marginal effects of introducing a product inside and outside a firm's primary line are contingent on the number of product introductions by competitors. Exploitative introductions inside the primary line will yield greater benefits in more stable settings, while exploratory launches in non-primary lines will better address highly changed conditions:

Hypothesis 3a: *When the aggregate number of new product introductions by competitors is relatively low, a firm will decrease its likelihood of failure more by introducing a new product inside its primary line than outside it.*

***Hypothesis 3b:** When the aggregate number of new product introduction by competitors is relatively high, a firm will decrease its likelihood of failure more by introducing a new product outside its primary line than inside it.*

In conclusion, we have theorized that differences in within-business diversification have a substantial influence on the viability of firms in technology-intensive settings. Furthermore, we hypothesized that the level of technical and competitive change in an industry moderates the relationship between within-business diversity and firm survival.

METHODOLOGY

To test our ideas, we analyzed the population of U.S. personal computer manufacturers from the industry's founding in 1975 through 1994. Our sample included makers of microcomputers (e.g., the Apple Macintosh) and desktop and desk-side personal workstations (e.g., Sun Microsystems' SPARCstation). Data was drawn from a census listing purchased from the International Data Corporation (IDC) of all domestic firms and foreign subsidiaries that built such computers in the United States. Those listings were updated annually and provided dollar sales and some technical information on all models of personal computers that were introduced during the study period. From 1975-1994, 736 firms entered the industry, 576 failed, there were 3,445 firm-year observations, and firms introduced 6,727 products.

Since the IDC data did not provide information about product-line membership, two coders, one of whom is a co-author, worked independently to group each firm's products into lines using information that included product names, the type of microprocessor and system bus employed, and dates of introduction. The two coders first undertook a training run in which they each classified approximately 100 products in 10 firms. They then met and

discussed their decisions. Following that, they worked separately and achieved an 87.0% agreement rate across the rest of the sample. The remaining 13% were later classified after the two coders had met and reached a consensus decision about each discrepancy.

Dependent Variable

The dependent variable in each hypothesis was a failure rate, and a firm was coded as failing in year t if it sold no personal computers in year $t+1$. Failures included the deaths of entire firms and industry exits by multibusiness corporations (Hannan & Freeman, 1989: 267). Since most firms were single-business entities, failures of entire firms predominated, but some multibusiness corporations exited the industry (e.g., Canon, Tektronix), and we treated those events as failures. Eight acquisitions took place in the industry, but those were not treated as failures since acquired firms were maintained as operationally distinct entities (Ingram, 1993). For example, AT&T acquired NCR in 1991, but NCR was left intact and operated autonomously, so its purchase signaled a change in legal ownership, not the death of its operations.

Independent Variables

Primary-line diversification was calculated using an entropy measure and equaled $\sum P_i \ln(1/P_i)$, where P_i was the percentage of sales in the firm's primary line that the i^{th} product accounted for (Palepu, 1985). A firm's primary line was defined as the one with the highest level of sales in the prior year. This measure accounts for two elements of diversification: (1) the number of products, and (2) the relative importance of each (Palepu, 1985). We also controlled for across-line diversification using the same formula, but i indexed product lines, and P_i equaled the percentage of a firm's total sales accounted for by the i^{th} line's revenues.

Consistent with the statement of hypotheses 1a and 1b, each of these entropy measures was lagged by a year and updated annually.

Primary-line introductions counted the number of new products that a firm introduced within its primary line during the current year. It was determined by the product introduction dates in the IDC data. Similarly, *outside primary-line introductions* counted the number of new products introduced this year that were not members of a firm's primary line. To assess the level of external change, we calculated *competitor introductions*, which equaled the natural log of the total number of new products introduced in the industry during the current year, excluding introductions by the focal firm.

Control Variables

We controlled for several firm-level, industry-level, and community-level factors. Unless noted otherwise, all were measured in the current year and updated annually.

Organizational controls. Smaller firms fail at higher rates since they lack the stable routines, legitimacy, and slack resources of larger organizations (Hannan & Freeman, 1989), so we controlled for *firm size* by measuring the log of deflated annual sales in the prior year, which taps into a firm's scale of operations and financial slack (Henderson, 1999). Failure rates also vary with *firm age* (Hannan & Freeman, 1989), so we measured the number of years that an organization had participated in the personal computer industry. Its square was not significant.

Firms that change their organizational core face increased risks of failure, particularly in the near term (Amburgey, Kelly, & Barnett, 1993), and some personal computer firms altered their cores by changing technology strategies. In this industry, proprietary strategists developed their key technologies internally and emphasized performance and specialized

features, while standards-based strategists used technologies that conformed with publicly available specifications and emphasized efficiency and time-to-market with new components developed by suppliers (Henderson, 1999). Apple is an example of a proprietary strategist; Compaq and Gateway were standards-based.

To model strategy changes, which about 12% of the firms undertook, we did the following. First, products were deemed standards-based if they conformed with one of the three publicly available specifications that emerged in the industry, involving products with microprocessors that are Zilog Z80-compatible, Intel x86-compatible, or Sparc-compatible. All other personal computers were designated proprietary. Next, the *technology strategy* dummy was coded 1 if a firm derived over 50% of its annual sales from proprietary products and 0 otherwise. Then, *changed strategy* was coded 1 beginning in the year that a firm's sales switched to or from a proprietary majority. Once set at 1, it retained that value, and it was coded 0 otherwise. To assess the dynamic effects of change (Amburgey, et al., 1993), *change clock* was set to 0, and in firms that switched strategies, it recorded the elapsed years since the switch to or from a proprietary majority.

As noted earlier, some personal computer businesses were parts of multibusiness corporations. To control for any differences between those and stand-alone businesses, *multibusiness corporation* was coded 1 if a firm was part of a larger corporation (e.g. IBM) and 0 if it was a stand-alone entity.

Industry controls. Several controls assessed competitive conditions within the industry. *Population density* may affect failure rates (Hannan & Carroll, 1992); it equaled the log of the number of firms alive in a given year. Aside from contemporaneous density, *founding density*

may affect failure rates (Hannan & Carroll, 1992), so that variable equaled the population density in the year that a firm commenced sales. Its value did not vary with time.

Community controls. Firms using similar technologies often form communities whose members compete with one another, yet also share infrastructure and social legitimacy (Wade, 1995). Henderson (1999) listed 74 technical communities in this industry for the period 1975-1992. We utilized those lists and identified 33 more that emerged during 1993 and 1994 then coded several variables. *Community size*, which signals system-level economies of scale, was measured by logging of the total annual sales of personal computers in each community. This variable also controls for network externalities, which exist when customers find it increasingly beneficial to adopt the same technology used by others (Katz & Shapiro, 1985). A community's age may also affect its legitimacy and the datedness of its technology (cf. Stinchcombe, 1965), so *community age* was measured in years. The number of firms in a community may affect competition and legitimation, so *community density* was controlled. For the firms that were members of multiple communities, these measures were weighted by the number of products that a firm had in each of its several communities.

Failure Rate Estimation

The data from IDC were updated annually, so the year in which a firm failed was known, but not the precise month or day. Since firms were at risk of failing throughout the year, the objective was to recover what were actually continuous-time hazard rates. Discrete-time event history models that use a complimentary log-log function accomplish this by accounting for both the discrete nature of the available data, and the continuous nature of actual failure process (Allison, 1995).

RESULTS

Table 2 provides the means, standard deviation and correlations of all variables. With the exception of several correlations between competitor introductions and some of the controls for industry and community characteristics, correlations involving the independent variables were modest. In analyses not shown here, we experimented with dropping several of those controls to reduce collinearity. Results from those models were essentially identical to those reported below. Table 3 reports results of the discrete-time models of organizational failure rates. Model 1 contains the controls. Model 2 adds the predicted main effects, and model 3 further adds the predicted interactions. To reduce collinearity, model 4 drops the interactions of competitor introductions with across-line diversification and outside primary-line introductions since those terms were not significant and did not significantly improve fit. We evaluated the hypotheses using model 4 of Table 3.

Insert Tables 2 and 3 about here

Hypotheses 1a and 1b considered the interactive effects of competitor introductions and the primary product line diversity on failure rates. Figure 1 graphs that interaction across the observed range of primary-line diversity for three values of competitor introductions: “low” = $\mu - \sigma$; “medium” = μ ; and “high” = $\mu + \sigma$, where μ and σ are the mean and standard deviation of the number of products introduced by competitors. As noted earlier, the discrete-time event history models were estimated using a complimentary log-log function, so the probability of failure at time t is: $p(t) = 1 - \exp[-\exp(\beta \mathbf{x}_t)]$, where β is the row vector of estimated coefficients, and \mathbf{x}_t is a column vector of time-varying predictors. Since the

contribution of a predictor to the probability of failure is contingent on the other variables in \mathbf{x}_t , the curves in Figure 1 were derived using the means of the controls.

Insert Figure 1 about here

As hypothesis 1a predicted, when competitor introductions were numerous, failure rates increased with primary-line diversification, as indicated by the topmost, upward-sloping line in Figure 1. That outcome was driven by the positive and significant effect of the interaction of competitor introductions and primary-line diversity. As predicted by hypothesis 1b, failure rates decreased with primary-line diversification at relatively low levels of competitor introductions, as indicated by the bottommost, downward-sloping line in Figure 1.

Hypotheses 2a and 2b considered the interaction of competitor introductions and the number of new product introductions in a firm's primary line. As hypothesis 2a predicted, failure rates decreased with primary-line introductions when competitor introductions were relatively low, as indicated by the bottom line of Figure 2, which graphs that interaction. Contrary to hypothesis 2b, however, failure rates also decreased with primary-line introductions when competitor introductions were relatively high, as indicated by Figure 2's topmost line. As we expected in making that prediction, the interaction of competitor and primary-line introductions was positive and significant, so the benefit of offering a new product in a firm's primary line decreased as the environment changed more. That partially supports our thinking. However, the large, negative, and significant main effect of primary-line introductions dominated that interaction and therefore contradicted the formal statement of hypothesis 2b.

Insert Figure 2 about here

The final two predictions compared effects of product introductions inside and outside a firm's primary line, so we assessed the partial derivatives of the estimated failure rates with respect to each type of introduction. In terms of the coefficient labels in Table 3:

$$\partial \text{ failure} / \partial \text{ primary-line introduction} = b_2 + b_7 \text{ competitor introductions} , \quad (1)$$

$$\partial \text{ failure} / \partial \text{ outside primary-line introduction} = b_4 + b_9 \text{ competitor introductions} . \quad (2)$$

Here, equation 1 is the marginal effect of offering a new product inside a firm's primary line, and equation 2 is the marginal effect of an introduction outside that line. Hypotheses 3a and 3b compare the magnitudes of those effects at different levels of competitor introductions. As model 3 of Table 3 indicates, b_9 did not differ significantly from zero, so equation 2 simplifies to b_4 . In turn, we used the following inequalities to test, respectively, hypotheses 3a and 3b:

$$b_2 + b_7 (\text{competitor introductions} = \text{low}) < b_4 , \quad (3a)$$

$$b_2 + b_7 (\text{competitor introductions} = \text{high}) > b_4 . \quad (3b)$$

To do this, we performed several post-hoc F-tests using the coefficients in Table 3 and the observed range of competitor introductions. Inequality 3a proved to be true for values of competitor introductions that were 2 and 1 standard deviations below its mean ($p = .0011$ and $p = .0941$ respectively), so hypothesis 3a was supported. Similarly, inequality 3b proved to be true for competitor introduction values that were 1 and 2 standard deviations above its mean ($p = .0155$ and $p = .0028$ respectively). Hypothesis 3b was therefore supported.

DISCUSSION

Traditionally, the link between diversification and performance has been studied at the corporate level, but that has yielded weak and inconsistent results. Firms, however, diversify

not only across businesses, but within them. Our premise was that regardless of its effects across businesses, diversification matters a great deal inside them. We therefore developed and tested a model that considers resource sharing within and across those of a firm's product lines that are located in a single business and industry. We further deviated from prior research, which has focused on large, publicly traded firms, by studying an entire population of organizations, including many that were young and small, and examining how the link between diversification and performance is moderated by the amount of technological and competitive change taking place in a focal firm's environment due to simultaneous diversification moves by its competitors. The following discussion highlights several of our findings that have critical implications for future studies of diversification.

First, we found that the environmental context in which diversification occurred mattered a great deal. As Figure 1 indicates, having a more diversified primary product line decreased failure rates when the environment changed relatively little, but sharply increased them as the level of external change grew higher. Because of their corporate-level of analysis, prior studies of diversification have sampled multiple industries and used dummy variables to capture across-industry differences. That assumes that differences in environmental flux are stable across time, yet here, the degree of technological and competitive change, as measured by the log of the number of new product introductions by competitors, increased by over 700% across a 20-year period. Studies of other technology-intensive settings suggest similar variations across time as new technologies are invented, dominant designs emerge, and increasing competitive pressures escalate rates of change and innovation (D'Aveni, 1994; Tushman & Anderson, 1986; Wade, 1995). In turn, industry evolution of this sort casts doubt on the assumptions of prior studies of diversification.

In particular, our finding that the benefits of related diversification were contingent on the level of external change, coupled with evidence that industry volatility evolves across time (Gersick, 1991; Hannan & Freeman, 1989; Tushman & Anderson, 1986), implies that the weak and conflicting results of prior studies stemmed, in part, from unobserved differences within industries in their rates of competitive and technological change. Since industries are founded at different times and evolve at different rates, multi-industry studies are likely to have tapped into a broad, yet unmeasured range of environmental dynamism. If stable settings are receptive to exploiting a firm's existing skills via related diversification, while unstable settings demand the exploration of less related areas, future work should direct greater attention to the environmental and evolutionary context in which diversification occurs. Such contingencies have received much attention in organizational learning theory (March, 1991), yet relatively little in the diversification literature (see Chang, 1996, for an exception), so greater attention to environmental context and external demands for change is warranted.

The second finding that we wish to highlight regards resource mobility within firms. Prior research on corporate-level processes has concluded that resource transfers are viable across businesses in nearby industries (e.g., across different 4-digit SIC codes in the same 2-digit industry), but not, in general, across more distant ones (e.g., across businesses in different 2-digit industries) (Hoskisson, Hitt, Johnson, Moesel, 1993; Palepu, 1985). In comparison, we found significant differences in the effects of diversifying within and across product lines in the same 4-digit business. Had resources been highly mobile within businesses, we would not have seen those differences.

This indicates that resources in technology-intensive settings may be even less mobile than corporate strategy scholars have supposed, and managers may confront major barriers to transferring resources well before they step outside their business and industry. That occurred, we argued, because subgroups within businesses have disparate agendas, both technological and political, that contribute to inertia and constrain the flow of complex and tacit knowledge across subgroups. An opportunity for future research is to assess whether our findings hold in settings that are less technology-intensive and therefore less laden with tacit knowledge that makes resource transfers difficult.

Like all research, this study has its limitations. The innovative, fast-paced nature of the personal computer industry may create idiosyncrasies that limit the generalizability of our results. Similar tests in other settings are needed. Also, our dependent variables were failure rates, so comparisons to studies of other outcomes, such as profitability, require caution. The majority of firms in our sample were privately held, so data on profitability was unavailable.

Furthermore, while we have shown that within-business diversification has statistically significant effects, we cannot address its magnitude relative to corporate-level effects. That is due to our sample and the fact that the statistical techniques used in recent variance partitioning studies (e.g., Roquebert, Phillips, & Westfall, 1996; Rumelt, 1991), which show that business-unit effects explain much more variance in performance than corporate effects, require that all independent variables be time-invariant and categorical. Dummies that capture industry or corporate membership meet that criteria (e.g., Rumelt, 1991), but the many continuous measures employed here (e.g., diversification, firm size) do not. We can show, however, that business-level diversification matters a good deal, as evidenced by the

graphs in Figures 1 and 2, which show annual probabilities of failure varying from less than 5% to over 35% depending on primary-line diversity and new product introductions.

In conclusion, prior research has implicitly assumed that diversification is a corporate-level issue that falls within the purview of the relative handful of CEOs and top management teams that head the extraordinarily large organizations that populate COMPUSTAT, the Fortune 500 and other such listings. Yet that same research indicates that corporate effects are relatively small. In comparison, our theory and results suggest that within-business diversification has a profound impact on whether organizations survive and eventually make it into such listings. Rather than viewing diversification as a corporate-level issue involving decisions to enter and exit industries, diversification might be better conceived as a pattern of resource deployments within a specific industry that both enables and constrains a businesses' ability to cope with environmental change. In turn, this suggests a rich future research agenda aimed at bringing ideas about organizational evolution and selection into the realm of diversification and resource sharing.

REFERENCES

- Aldrich H, Auster ER. 1986. Even dwarfs started small: Liabilities of age and size and their strategic implications. *Research in Organizational Behavior* **8**: 165-198.
- Allison PD. 1995. *Survival analysis using the SAS System*. Cary, NC: SAS Institute.
- Amburgey TL, Kelly D, Barnett WP. 1993. Resetting the clock: The dynamics of organizational change and failure. *Administrative Science Quarterly* **38**: 51-73.
- Barnett WP. 1997. The dynamics of competitive intensity. *Administrative Science Quarterly* **42**: 128-160.
- Barron DN, West E, Hannan MT. 1994. A time to grow and a time to die: Growth and mortality of credit unions in New York City: 1914-1990. *American Journal of Sociology* **100**: 381-421.
- Brown LS, Eisenhardt KM. 1995. Product development: past research, present findings, and future directions. *Academy of Management Review* **20**: 343-378.
- Brush TH, Bromiley P, Hendrickx M. 1999. The relative influence of industry and corporation on business segment performance: An alternative estimate. *Strategic Management Journal* **20**: 519-547.
- Baum JAC, Korn HJ. 1996. Competitive dynamics of interfirm rivalry. *Academy of Management Journal* **39**: 255-291.
- Baum JAC, Korn HJ. 1999. Dynamics of dyadic competitive interaction. *Strategic Management Journal* **20**: 251-279.
- Capon N, Farley JU, Hoenig S. 1990. Determinants of financial performance: A meta-analysis. *Management Science* **36**: 1143-1159.
- Carroll GR. 1993. A sociological view on why firms differ. *Strategic Management Journal* **14**: 237-249.
- Chandler AD. 1962. *Strategy and Structure*. Cambridge, MA: MIT Press.
- Chang SJ. 1996. An evolutionary perspective on diversification and corporate restructuring: Entry, exit, and economic performance during 1981-89. *Strategic Management Journal* **17**: 587-611.
- Chatterjee S. 1986. Type of synergy and economic value: The impact of acquisitions on merging and rival firms. *Strategic Management Journal* **7**: 119-139.
- Christensen CM. 1997. *The innovator's dilemma*. Boston, MA: Harvard Business School Press.

- Cohen WM, Levinthal DA. 1990. Absorptive capacity: A new perspective on learning and innovation. *Administrative Science Quarterly* **35**: 128-152.
- Cyert RM., March JG. 1963. *A behavioral theory of the firm*. Englewood Cliffs, NJ: Prentice-Hall.
- D'Aveni RA. 1994. *Hypercompetition: Managing the dynamics of strategic maneuvering*. New York: Free Press.
- Davis PS, Robinson RB JR, Pearce JA II, Park SH. 1992. Business unit relatedness and performance: A look at the pulp and paper industry. *Strategic Management Journal* **13**: 349-361.
- Dess, GG, & Beard, DW. 1984. Dimensions of organizational task environments. *Administrative Science Quarterly*, 29: 52-73.
- Dobrev SD, Kim TY, Hannan MT. 2001. Dynamics of niche width and resource partitioning. *American Journal of Sociology* **106**(5): 1299 – 1337.
- Dosi G. 1988. Sources, procedures, and microeconomic effects of innovation. *Journal of Economic Literature* **26**: 1120-1171.
- Drazin R, Rao H. 2002. Harnessing managerial knowledge to implement product line extensions: How do mutual fund families allocate portfolio managers to old and new funds? *Academy of Management Journal*, **45**(3) 609-619.
- Eisenhardt KM. 1989. Making fast strategic decisions in high-velocity environments. *Academy of Management Journal* **32**: 543-576.
- Eisenhardt KM, Tabrizi BN. 1995. Accelerating adaptive processes: product innovation in the global computer industry. *Administrative Science Quarterly* **40**: 84-110.
- Elgers PT, Clark JT. 1980. Merger types and shareholder wealth returns: Additional evidence. *Financial Management* **9** (Summer): 66-72.
- Freeman J, Hannan MT. 1983. Niche width and the dynamics of organizational populations. *American Journal of Sociology* **88**: 1116 – 45.
- Gersick CJG. 1991. Revolutionary change theories: A multilevel exploration of the punctuated equilibrium paradigm. *Academy of Management Review*, **16**: 10-36.
- Hannan, MT, Carroll GR. 1992. *Dynamics of organizational populations: Density, legitimation, and competition*. New York: Oxford University Press.
- Hannan MT, Freeman J. 1984. Structural inertia and organizational change. *American Sociological Review* **49**: 149-164.

- Hannan, M. T., & Freeman, J. 1989. *Organizational ecology*. Cambridge, MA: Harvard University Press.
- Hansen, MT. 1999. The search-transfer problem: the role of weak ties in sharing knowledge across organizational subunits. *Administrative Science Quarterly* **44**: 82-111.
- Heckman JJ. 1979. Sample selection bias as a specification error. *Econometrica* **47**: 153-161.
- Henderson AD. 1999. Firm strategy and age dependence: A contingent view of the liabilities of newness, adolescence, and obsolescence. *Administrative Science Quarterly* **44**: 281-314.
- Henderson R, Clark KB. 1990. Architectural innovation: The reconfiguration of existing product technologies and the failure of established firms. *Administrative Science Quarterly* **35**: 9-30.
- Hill CWL, Hitt MA, Hoskisson RE. 1992. Cooperative versus competitive structures in related and unrelated diversified firms. *Organization Science* **3**: 501-521.
- Hoskisson, R.E. and R.A. Johnson. 1992. Corporate restructuring and strategic change: The effect on diversification strategy and R&D intensity. *Strategic Management Journal* **13**: 625-634.
- Hoskisson RE, Hitt MA., Johnson RA, Moesel DD. 1993. Construct validity of an objective (entropy) categorical measure of diversification strategy. *Strategic Management Journal* **14**: 215-235.
- Ingram, PL. 1993. Old, tired, and ready to die: The age dependence of organizational mortality reconsidered. *Paper presented at the annual meeting of the Academy of Management*, Atlanta, Georgia.
- Jones GR, Hill CWL. 1988. Transaction cost analysis of strategy-structure choice. *Strategic Management Journal* **9**: 159-172.
- Kahneman D, Tversky A. 1979. Prospect theory: An analysis of decision under risk. *Econometrica* **47**: 263-291.
- Kogut B, Zander U. 1992. Knowledge of the firm, combinative capabilities, and the replication of technology. *Organization Science* **3**: 383-397.
- Kotler P. 1997. *Marketing management: analysis, planning, implementation, and control*. Upper Saddle River, NJ: Prentice Hall.
- Lawrence PR, Lorsch JW. 1967. Differentiation and integration in complex organizations. *Administrative Science Quarterly* **12**: 1-47.

- Leblebici H, Salancik GR, Copay A, King T. 1991. Institutional change and the transformation interorganizational fields: An organizational history of the U.S. radio broadcasting industry. *Administrative Science Quarterly* **36**: 333-363.
- Levinthal DA. 1991. Organizational adaptation and environmental selection – interrelated processes of change. *Organization Science* **2**: 140-145.
- Lindblom CE. 1959. The science of "muddling through". *Public Administration Review* **19**: 79-88.
- Lubatkin M. 1987. Merger strategies and stockholder value. *Strategic Management Journal* **8**(1): 39-59.
- Lubatkin M, Rogers RC. 1989. Diversification, systematic risk, and shareholder return: A capital market extension of Rumelt's 1974 study. *Academy of Management Journal*, **32**: 454-465.
- Luke, RD, Begun, JW, Pointer DD. 1989. Quasi firms: Strategic Interorganizational forms in the health care industry. *Academy of Management Review* **4**: 9-19.
- March, JG. 1991. Exploration and exploitation in organizational learning. *Organization Science*, **2**: 71-87.
- Markides CC, PJ Williamson. 1994. Related diversification, core competencies and corporate performance. *Strategic Management Journal* **15**(Summer special Issue): 149-165.
- McGahan AM, Porter ME. 1997. How much does industry matter, really? *Strategic Management Journal*, **18**(special issue), 15-30.
- Michel A, Shaked I. 1984. Does business diversification affect performance?. *Financial Management* **13**(4): 18-25.
- Monge PR, Rothman LW, Eisenberg EM, Miller KL, Kirste K. 1985. The dynamics of organizational proximity. *Management Science* **31**: 1129-1141.
- Nelson RR, Winter **SG**. 1982. *An evolutionary theory of economic change*. Cambridge, MA: Harvard University Press.
- Palepu K. 1985. Diversification Strategies, Profit Performance and the Entropy Measure. *Strategic Management Journal* **6**: 239-255.
- Palich LE, Cardinal LB, Miller CC. 2000. Curvilinearity in the diversification-performance linkage: An examination of over three decades of research. *Strategic Management Journal* **21**: 155-174.

- Palmer D, Friedland R, Jennings PD, Powers ME. 1987. The Economics and Politics of Structure: The Multidivisional Form and the Large U.S. Corporation. *Administrative Science Quarterly* **32**: 25-48.
- Pfeffer J, Salancik GR. 1978. *The external control of organizations*. New York: Harper & Row.
- Roquebert JA, Phillips RL, & Westfall PA. 1996. Markets vs. management: What 'drives' profitability? *Strategic Management Journal* **17**: 653 – 664.
- Rumelt RP. 1974. *Strategy, structure, and economic performance*. Boston, MA: Harvard Business School Press.
- Rumelt RP. 1991. How much does industry matter? *Strategic Management Journal* **12**: 167-185.
- Rumelt RP. 1982. Diversification strategy and profitability. *Strategic Management Journal* **3**: 359-369.
- Singh H, Montgomery CA. 1987. Corporate acquisition strategies and economic performance. *Strategic Management Journal* **8**: 377-386.
- Sorenson O. 2000. Letting the market work for you: An evolutionary perspective on product strategy. *Strategic Management Journal* **21**: 577-592.
- Stinchcombe AL. 1965. Social structure and organizations. In J. G. March (Ed.), *Handbook of Organizations*: 142-193. Chicago: Rand McNally.
- Tushman ML. 1977. A political approach to organizations: A review and rationale. *Academy of Management Review* April: 206-216.
- Tushman ML, Anderson, P. 1986. Technological discontinuities and organizational environments. *Administrative Science Quarterly* **31**: 439-465.
- Varadarajan P, Ramanujam V. 1987. Diversification and performance: a reexamination using a new two-dimensional conceptualization of diversity of firms. *Academy of Management Journal* **30**: 380-393.
- Wade J. 1995. Dynamics of organizational communities and technological bandwagons: An empirical investigation of community evolution in the microprocessor market. *Strategic Management Journal* **16**:111-133.

TABLE 1
General Motors and Honda Motor Co. Automotive Businesses (SIC = 3711)














General Motors	Chevrolet Trucks:  CHEVROLET	Astro, Avalanche, Blazer, Express, S-10 Pickup, Silverado, Silverado HD, Suburban, Tahoe, Tracker, TrailBlazer
	Chevrolet Vans:  CHEVROLET	Astro, Express, Venture
	Chevrolet Cars:  CHEVROLET	Camaro, Cavalier, Corvette, Impala, Malibu, Monte Carlo, Prizm, Venture
	Buick :  BUICK	LeSabre, Park Avenue, Regal, Century, Rendezvous
	Cadillac :  Cadillac	Deville, Escalade, Seville, XLR, CTS, Escalade EXT, Eldorado
	GMC :  GMC	Envoy, Jimmy, Safari, Savana, Sierra, Sierra HD, Sonoma, Yukon, Yukon XL, Yukon XL Denali
	Hummer :  HUMMER	H1, The Future of Hummer, H2
	Oldsmobile :  Oldsmobile	Alero, Aurora, Bravada, Intrigue, Silhouette
	Pontiac :  PONTIAC	Sunfire, Grand Am, Grand Prix, Firebird, Bonneville, Aztek, Montana
	Saab :  SAAB	Saab 9-5, Saab 9-3, Saab 9-3 Convertible
Saturn :  SATURN	3Door Coupe, S-Series	
American Honda Motor Co.	Honda Automobiles: 	Accord Sedan, Accord Coupe, Civic Sedan, Civic Coupe, CR-V, Insight, Odyssey, Passport, Prelude, S2000
	Acura Automobiles: 	RL, TL, CL, RSX, NSX, MDX

TABLE 2
Means, Standard Deviations, and Correlations[•]

Variable	Mean	s.d.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1. Primary-line diversification	0.44	0.58															
2. Primary-line introductions	1.20	2.02	.33														
3. Across-line diversification	0.17	0.34	.36	.21													
4. Outside primary-line introductions	0.72	3.31	.32	.36	.40												
5. Competitor introductions	5.79	1.06	.44	.28	.25	.16											
6. Firm size	8.13	2.40	.48	.23	.47	.30	.21										
7. Firm age	4.15	3.19	.51	.17	.46	.30	.29	.59									
8. Technology strategy	0.31	0.46	-.10	-.09	.06	.03	-.30	.16	.21								
9. Changed strategy	0.12	0.33	.11	.03	.17	.09	.01	.21	.39	.34							
10. Change clock	0.49	1.61	.24	.14	.20	.23	.09	.26	.48	.32	.80						
11. Multibusiness corporation	0.19	0.39	.11	.08	.23	.13	-.12	.37	.30	.32	.13	.16					
12. Population density (log)	5.37	0.52	.23	.08	.14	.04	.80	.08	.17	-.28	.05	.07	-.14				
13. Founding density	190.35	95.91	.12	.13	-.04	-.03	.68	-.19	-.37	-.48	-.28	-.26	-.32	.61			
14. Community size	14.95	2.35	.32	.22	.16	.11	.66	.13	.12	-.52	.05	.09	-.15	.62	.55		
15. Community age	8.51	3.17	.45	.28	.24	.17	.76	.23	.37	-.29	.02	.11	-.14	.47	.42	.54	
16. Community density	171.73	106.88	.29	.15	.07	.05	.63	.02	.05	-.55	.00	.06	-.21	.66	.64	.80	.44

• N = 3,445 firm-years.

TABLE 3
Discrete-Time Event History Analyses of Organizational Failure Rates

Predictor Variables	Model			
	(1)	(2)	(3)	(4)
b ₁ : Primary-line diversification		0.134 (0.104)	-2.213 * (1.055)	-2.501 * (1.049)
b ₂ : Primary line introductions		-0.295 *** (0.042)	-2.213 *** (0.475)	-2.067 *** (0.475)
b ₃ : Across-line diversification		-0.317 (0.187)	-2.453 (2.005)	-0.298 (0.186)
b ₄ : Outside primary-line introductions		-0.361 *** (0.852)	-1.654 (1.019)	-0.366 *** (0.083)
b ₅ : Competitor introductions		0.700 *** (0.125)	0.416 ** (0.140)	0.441 ** (0.139)
b ₆ : Competitor introductions x primary-line diversification			0.363 * (0.162)	0.408 * (0.161)
b ₇ : Competitor introductions x primary-line introductions			0.266 *** (0.070)	0.266 *** (0.070)
b ₈ : Competitor introductions x across-line diversification			0.335 (0.307)	
b ₉ : Competitor introductions x outside primary-line introductions			0.194 (0.151)	
Firm size	-0.186 *** (0.023)	-0.140 *** (0.025)	-0.145 *** (0.026)	-0.147 *** (0.026)
Firm age	-0.016 (0.025)	-0.081 ** (0.030)	-0.103 ** (0.032)	-0.100 ** (0.032)
Technology strategy	0.077 (0.142)	-0.029 (0.142)	-0.026 (0.142)	-0.028 (0.142)
Changed strategy	-0.923 ** (0.290)	-0.973 ** (0.317)	-0.893 ** (0.317)	-0.922 ** (0.315)
Change clock	0.135 ** (0.050)	0.170 ** (0.057)	0.164 ** (0.057)	0.167 ** (0.057)
Multibusiness corporation	-0.369 ** (0.158)	-0.119 (0.157)	-0.083 (0.157)	-0.088 (0.157)
Population density (log)	0.753 *** (0.187)	0.197 (0.207)	0.624* (0.245)	0.565 * (0.241)
Founding density	-0.002 ** (0.001)	-0.005 *** (0.001)	-0.005 *** (0.001)	-0.005 *** (0.001)
Community size	-0.182 *** (0.033)	-0.173 *** (0.032)	-0.171 *** (0.032)	-0.742 *** (0.032)
Community age	0.198 *** (0.021)	0.134 *** (0.024)	0.129 *** (0.025)	0.131 *** (0.025)
Community density	0.003 *** (0.001)	0.002 ** (0.001)	0.003 *** (0.001)	0.003 *** (0.001)
-2 * log likelihood	2744.937 ***	2606.226 ***	2581.818 ***	2585.187 ***
Δ fit from prior model (χ^2)		138.710 ***	24.408 ***	3.369

* p < .05; ** p < .01; *** p < .001; two-tailed tests

FIGURE 1
Interactive Effects of Competitor Introductions and Primary-line Diversification
on Organizational Failure Rates

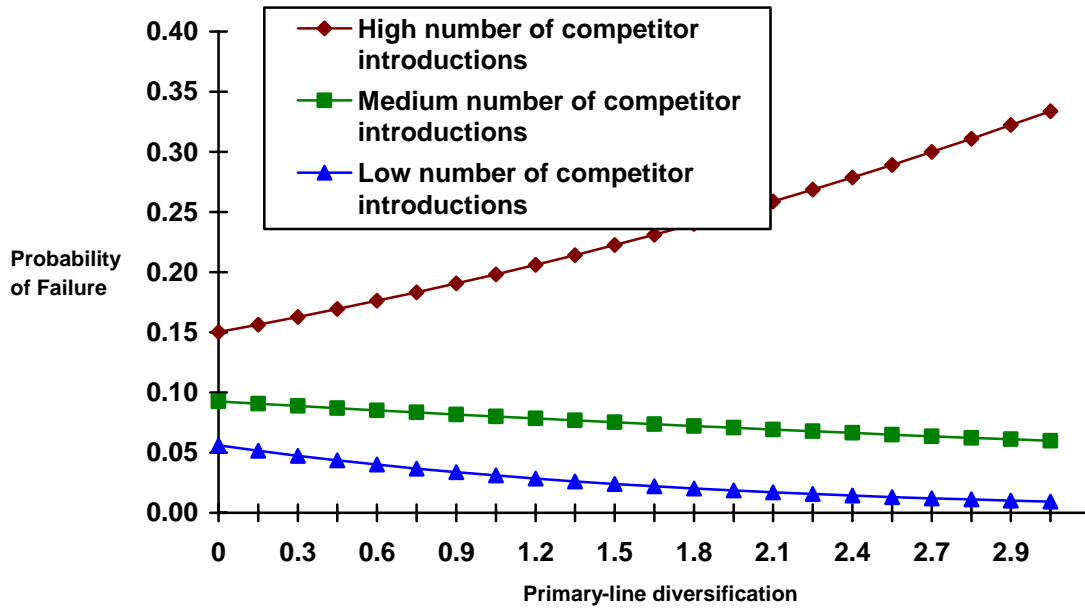


FIGURE 2
Interactive Effects of Competitor Introductions and Primary-line Introductions
on Organizational Failure Rates

