Strategic Management Journal
Strat. Mgmt. J., **37**: 2323–2345 (2016)
Published online EarlyView in Wiley Online Library (wileyonlinelibrary.com) DOI: 10.1002/smj.2568
Received 1 October 2014; Final revision received 10 August 2016

THE DYNAMICS OF DIVERSIFICATION: MARKET ENTRY AND EXIT BY PUBLIC AND PRIVATE FIRMS

DOUGLAS J. MILLER[1]* and HSIAO-SHAN YANG[2]
[1] *Department of Management and Global Business, Rutgers, The State University of New Jersey, Piscataway, New Jersey, U.S.A.*
[2] *Institute for Genomic Biology, Business, Economics, and Law of Biotechnology (BioBEL) Theme, University of Illinois at Urbana-Champaign, Urbana, Illinois, U.S.A.*

***Research summary**: We replicate one of the first studies on the dynamics of diversification, Chang (1996). Our sample of public and private firms from 1992 to 2001 yields findings similar to the earlier research. Firms tend to enter new markets that have human resource profiles that are similar to the firms' existing businesses, and exit markets that have dissimilar human resource profiles. This general finding is robust to alternative specifications and controls, including the timing of market entry and technological diversification. However, we also find that entry and exit by private firms is much more prevalent than that by public firms. Differences in how public and private firms diversify based on knowledge similarity invite further research in evolutionary economics.*

***Managerial summary:** Chang (1996) revealed that large, public manufacturing firms in the 1980s tended to enter new businesses that leveraged the firm's knowledge, some of which is embedded in routines among employees sharing similar occupations. The new businesses provide the basis for further expansion, while a firm divests businesses that do not stay profitable, or which no longer match the firm's new portfolio of businesses. Our data show that these patterns continued in the 1990s. Our sample also includes private firms, which conduct the majority of market entry and exit. Private firms enter new businesses with different proportions of scientific and marketing personnel than their existing operations. Thus, diversification still reflects knowledge resources for smaller, private firms, but differently than for the largest firms in the economy.*

INTRODUCTION

In this article, we replicate and extend the research of Chang (1996), which was the first empirical paper to use a resource-based measure of related diversification and consider both expansions and reductions in firm scope over time.[1] In his landmark paper, he made three main contributions to an evolutionary economics view (Nelson and Winter, 1982) of how diversification develops. First, he considered market entry and exit together, which

Keywords: diversification; resource-based view; market entry; market exit; replication
*Correspondence to: Douglas J. Miller. Department of Management and Global Business, Rutgers, The State University of New Jersey, 100 Rockafeller Road, Piscataway, New Jersey, U.S.A. E-mail: doug.miller@rutgers.edu

[1] Starting with Gort's (1962) seminal book, a few other dynamic analyses of diversification predate Chang (1996), primarily focused on explaining firm financial performance, not behavior. In the management literature, Palepu (1985) tested one longitudinal hypothesis about related diversification, Hill and Hansen (1991) examined changes in diversification in the U.S. pharmaceutical industry, and Pennings, Barkema, and Douma (1994) analyzed "expansion projects" (i.e., market entry) in terms of organizational learning.

allowed insights on organizational learning. Chang (1996) explained that the addition and subtraction of businesses in the corporate portfolio may be vital for the firm to learn and develop new capabilities. Second, Chang (1996) was one of the first to employ longitudinal data to study sequencing of market entry and exit, demonstrating path dependence consistent with a behavioral approach to search. Third, he considered firm financial performance as both a motivation for change and an outcome of a firm's search strategy, foreshadowing later extensive attention to issues of endogeneity in corporate scope (e.g., Miller, 2006; Villalonga, 2004).

Clear understanding of diversification is critical to the field of strategic management. The decision to expand the scope of the firm by entering new markets is made by the highest-ranking managers of a firm, and has implications for every other aspect of corporate strategy. Early research identified diversification as a key aspect of firms' success and growth (Ansoff, 1957; Penrose, 1959). The resource-based view (e.g., Barney, 1986; Rumelt, 1974; Wernerfelt, 1984) built on Penrose's framing of the question and explained how firm-specific resources contribute to firms' decisions to develop distinctive portfolios of businesses, which are heterogeneous not only in the level of product diversification, but also in the content of that diversification (Mahoney and Pandian, 1992). Sharable managerial resources and inputs induce product-market diversification (Jovanovic, 1993; Teece, 1982), given transaction costs or asset indivisibility (Teece, 1980). Knowledge-based resources are especially important since they are foundational to competitive advantage, redeployable, and difficult to transfer across firm boundaries (e.g., Grant, 1996; Kogut and Zander, 1992; Markides and Williamson, 1994; Wu, 2013). Thus, by leveraging fungible and scalable assets, related diversification has the potential to outperform unrelated diversification or a more focused corporate strategy (Rumelt, 1974). In the 20 years after Rumelt's dissertation, the empirical literature on diversification developed refined measures of resource-based relatedness, typically applied in cross-sectional research designs and nearly always employing samples of large, public corporations (Farjoun, 1990; Markides and Williamson, 1994; Robins and Wiersema, 1995). During this same period, a distinct literature on divestment and refocusing (e.g., Duhaime and Grant, 1984; Harrigan, 1980) began to intersect with the diversification literature (e.g., Hoskisson and Johnson, 1992; Montgomery, Thomas, and Kamath, 1984), examining strategic reductions in firm scope, but still primarily employing cross-sectional tests for samples of large firms.

Recently, strategic management scholars have placed renewed emphasis on the *dynamics* of corporate strategy. Theorists are seeking to better define and examine particular constructs such as scale-free assets (Levinthal and Wu, 2010; Wu, 2013), and also develop broader theory on the interplay of firm-level and industry-level evolution (e.g., de Figueiredo and Silverman, 2007), in dialogue with Industrial Organization Economics (e.g., Bernard, Redding, and Schott, 2010; de Figueiredo and Kyle, 2006). Others have clarified that synergy across businesses can be created by demand-side drivers of value, which may change over time (Adner, 2002; Priem, Li, and Carr, 2012); and that resource redeployment can create intertemporal economies of scope (e.g., Helfat and Eisenhardt, 2004; Sakhartov and Folta, 2014, 2015). These issues affect research on other corporate strategy topics such as mergers and acquisitions (M&A), choice of alliance partner, multidivisional (M-form) structure organizational structure, or vertical integration (e.g., Capron, Mitchell, and Swaminathan, 2001; Villalonga and McGahan, 2005). Therefore, we replicate an early and important empirical paper on the dynamics of diversification—for a later time period and incorporating additional controls and robustness checks—to support and inform ongoing research. Moreover, we extend our replication by also evaluating Chang's hypotheses in the context of both manufacturing and nonmanufacturing public firms and private firms. Resource-based theory implies major attention to entrepreneurial processes and firms (Alvarez and Barney, 2007; Foss *et al.,* 2008). Suppose corporate strategy decisions early in the life of a firm influence its later decisions, such as developing a preference for acquisitions rather than alliances, or there are other types of path dependence in entry and exit. In such cases, samples that include only large, public firms might yield biased conclusions because of unobserved self-selection.

Chang (1996) used TRINET data from 1981 to 1989 to observe entry and exit of firms in 132 manufacturing industries across two-year time windows. He defined relatedness according to human resource profiles in various industries, adapting Farjoun's (1990, 1998) approach. His empirical results support the hypotheses that a firm has a higher propensity to diversify into industries that are more related to its current knowledge portfolio and exit relatively unrelated industries. Subsequent longitudinal studies of the timing and direction of diversification have corroborated his results using firm-level measures of knowledge (e.g., Silverman, 1999) or survey methodology (Capron *et al.,* 2001).

Our replication employs a detailed panel dataset of product classifications to document the dynamics of market entry and exit, and includes a similar number of firms and industries for a later time period. Our longitudinal data drawn from CorpTech cover 442 distinct four-digit Standard Industrial Classification (SIC) codes during 1991–2001. The analyses corroborate Chang's (1996) findings that public manufacturing firms are more likely to engage in "extensive" entries into new (three-digit SIC) markets that have a similar human resource profile as their existing lines of business, particularly those that the firm most recently added. However, a much lower incidence of "intensive" entry (new four-digit SIC businesses within existing three-digit SIC markets) in our time period leads to some findings that differ from Chang's. Also, we corroborate that firms are more likely to exit markets that require dissimilar human capital, and poor performance leads to more exit in general. While a full replication of Chang (1996) is not possible for private firms, we extend his study by reporting on their entry and exit behavior and offer exploratory tests that suggest they too evolve according to human resource profiles. However, marketing and scientific human resources drive path-dependent entry for private manufacturing firms, while managerial and marketing human resources matter more for private nonmanufacturing firms. In extensions, we check the robustness of the replication results when including variables proposed in other research about market entry and exit (Miller, 2004; Mitchell, 1991). These findings highlight the importance of understanding corporate diversification both for the evolution of firms and their capabilities, and for the dynamics of markets.

A DYNAMIC THEORY OF DIVERSIFICATION

Chang (1996) describes market entry and exit as a sequential search and selection process (Nelson and Winter, 1982): firms seek to leverage existing knowledge and gain new knowledge-based capabilities. Chang states: "we can learn more from examining both diversification and restructuring activities together to understand the scope of the firm as opposed to treating these as discrete events" (1996: 609). Chang (1996) stated five propositions; then, after explaining the research design and measures, he restated each proposition as a hypothesis specific to those measures. Next, we review the theory behind the first four propositions, ending each section with a statement of Chang's (1996) hypotheses. We do not consider the fifth proposition, "A firm will improve its performance as a consequence of search and selection" (1996: 593) because substantial literature since Chang (1996) has addressed the financial performance of diversified firms (Berger and Ofek, 1995; Bettis, 1981; Campa and Kedia, 2002; Lang and Stulz, 1994; Markides and Williamson, 1994; Miller, 2006; Palich, Cardinal, and Miller, 2000; Robins and Wiersema, 1995; Villalonga, 2004).[2]

Performance gap

In evolutionary economics (Nelson and Winter, 1982), knowledge is embedded in routines. The firm is not only a repository of knowledge or other intangible resources, it is also engaged in a continuous process to upgrade its knowledge in order to improve performance. While all firms feel pressure from the stock market to improve performance, a "performance gap"—a clear discrepancy between the firm's current performance and its expected performance (Duncan and Weiss, 1979)—leads managers to conduct problemistic search (e.g., investment in new knowledge) and more rigorous selection (e.g., divestiture of businesses without competitive advantage) beyond the level of most firms (Chang, 1996). Within a single-business firm, R&D may be the primary means of problemistic search. For a multibusiness firm, corporate headquarters often uses acquisitions and divestitures to implement search and selection, respectively. Profitability provides feedback for selection decisions and also influences the direction of search.

Hypothesis 1 (H1): After controlling for financial resources and firm size, the poorer the

[2] Chang (1996) used the change in ROA and operating cash flows (OCF) over a 14-year period to measure performance. In our view, later research that controlled for riskiness of cash flows and self-selection of diversification strategy greatly improved the specification of models for testing the relationship between diversification and financial performance.

DOI: 10.1002/smj

performance, the more likely that firms will initiate (a) entry and (b) exit. (Chang, 1996: 599, 604*)*

Knowledge applicability

Chang further contends, "each line of business is a repository of the firm's operational knowledge base embedded in its routines … [and] we can approximate a firm's knowledge base by looking at its human resource profile" (1996: 589). Although people may not be fully aware of the way in which routines work to create outcomes, in some sense any knowledge the firm has ultimately resides in the people who conduct routinized activities. Managers are aware of their existing capabilities, but have limited knowledge of how these capabilities may fit with the demands of other businesses. Rather than experimentation being purely random, therefore, learning about new industries will center on possibilities in which the firm's existing knowledge base is likely to apply. Similarly, since firms seek to weed out underperforming divisions in the selection process, "firms will generally divest businesses whose knowledge bases are different from the other lines of business" (Chang, 1996: 591). Controlling for industry growth and other characteristics, the implication for the relationship between internal capabilities and search and selection is:

Hypothesis 2 (H2): After controlling for industrial market structure, firms will be more likely to (a) enter an industry of similar human resource profile and (b) exit an industry of dissimilar human resource profile. (*Chang,* 1996: 599, 604)

Sequential search and selection

A cross-sectional approach to diversification might emphasize that a firm's knowledge base provides the initial basis for search and selection, constraining the firm to grow into only closely related areas. Chang (1996) explains that the pattern of diversification over time is path dependent not only because of these starting conditions, but also because knowledge can be expanded through experimentation. To pursue attractive opportunities in unrelated industries, a firm can enter "intermediate industries" (1996: 591) to bridge from the knowledge it has to the knowledge it will need. Evaluated period by period, this logic leads to a gradual movement along a trajectory, such that a current decision (in time t) about where to enter will be influenced more by the firm's recent history (time $t-1$) than its historic core competence (time $t-2$ and beyond). Regarding selection, the growing firm will find itself operating businesses that no longer match the emerging boundaries of its capabilities, and as stated in Hypothesis 2 (H2), will divest those businesses that do not fit, even if those businesses were part of the firm's historic core. Also, a sequence of divestitures takes time, so the results of search experiments (via entry) will be known and considered in exit decisions.

Hypothesis 3 (H3): A firm will (a) search for an industry to enter at time t *whose human resource profile is similar to those of industries that the firm previously entered at time* t – 1*, and (b) divest lines of business in order from lines of business whose human resource profiles are less similar to the firm to lines of business whose human resource profiles are more similar. (Chang,* 1996: 599, 604*)*

Choice in the search mode

Chang's fourth proposition treats "search rules" (1996: 592) as a special type of routine. He distinguishes between intensive search and extensive search (Levinthal and March, 1981). Mapping this distinction onto diversification, intensive search is "entry into a related business area" and extensive search is "entry into an unrelated field" requiring search along "a new knowledge dimension" (1996: 592). The choice between intensive or extensive search is affected by performance (i.e., Hypothesis 1 (H1)) and the set of external opportunities available, which is constrained by the applicability of a firm's knowledge (i.e., H2), including its breadth of knowledge, and its recent pattern of search (i.e., Hypothesis 3 (H3)). However, the choice between intensive or extensive search is also affected by the propensity to continue using methods that have worked before. On average, a firm will start out diversifying into related areas to exploit its knowledge, and only after it realizes diminishing returns (in business unit performance) will it explore by attempting extensive search. If extensive search is unsuccessful, the firm will still be in a state of poor performance, and must continue to explore further;

but if the extensive search is successful, "the next thing the firm should do is to exploit the newly explored business through an intensive search" (Chang, 1996: 593). Therefore, a firm will tend to follow intensive search with more intensive search up to a limit (defined by failure), and will tend to follow extensive search with more extensive search up to a limit (defined by success). Chang (1996) states it thusly:

> *Hypothesis 4 (H4): (1) The extensiveness of a firm's search at a previous time will have a positive relation with the likelihood to initiate extensive search at time* t; *(2) The accumulation of extensive search until time* t – 1 *will have a negative relation with the likelihood to initiate extensive search at the next time period. (Chang,* 1996: 599)

In the following analysis, we replicate Chang's tests of these specific hypotheses.

METHODS

Research on corporate strategy in the United States has typically used data from the annual reports of publicly held companies, as compiled in Compustat. Additional databases employed to study particular time periods include TRINET (biannually from 1981 to 1989) and the Federal Trade Commission Line of Business data (1974–1977). These data distinguish product markets according to government-assigned SIC or NAICS codes. Chang (1996) linked all public, U.S. manufacturing companies with establishment data in TRINET to their annual report data in Compustat. Dropping companies that were acquired, merged, or went bankrupt between 1981 and 1989 and any with missing information yielded Chang's (1996) final sample of 772 firms.

Some literature in economics and marketing adapts more detailed product-level information from sources such as the *Thomas Register of American Manufactures* (e.g., Agarwal and Gort, 2002; Gort and Klepper, 1982; Klepper and Graddy, 1990) or MarketLine, similar to how Villalonga (2004) uses the restricted Business Information Tracking Series (BITS) data to re-evaluate relatedness in diversification. Our data comes from CorpTech, which has been cited in studies of entry timing (Lee, 2008) and acquisitions (Lee and Lieberman, 2010; Puranam and Srikanth, 2007). CorpTech is a directory of high-tech industry manufacturers generated through an annual survey (Lavin, 1992), and includes information on name, address, and other contact information, but also firm-level employment, sales, year of establishment, and a fine-grained, propriety product classification system. The industries are Factory Automation, Biotechnology, Chemicals, Computer Hardware, Defense, Energy, Environmental, Manufacturing Equipment, Advanced Materials, Medical Equipment, Pharmaceuticals, Photonics, Computer Software, Subassemblies & Components, Test & Measurement, Telecommunications & Internet, and Transportation. CorpTech covers more than 67,017 private and public firms across 17 high-tech industries, 442 four-digit Standard Industrial Classification (SIC) categories, and 2,600 product markets in the United States between 1989 and 2004 annually.[3] Along with designating SIC and NAICS codes, CorpTech defines four levels of proprietary market definitions. Within the industry Computer Hardware would be sub-industries such as Computer Memory Systems and Computer Input Devices; within Computer Input Devices would be product markets including Keyboards, Trackballs, and Mouse Input Devices. A product would be a particular shape of mouse or model of keyboard, so a single brand could include many products within a product market. A CorpTech sub-industry roughly corresponds to a three-digit SIC code, while product markets are more detailed than four-digit SIC codes. Thus, entry or exit into a product market is a substantive change in the firm's offerings, not merely dropping or adding a single product. For all CorpTech-derived measures, we aggregate subsidiaries up to the corporate level.

This method yields coverage of the population of public manufacturing firms similar to that in Chang (1996). To replicate prior research, we employ SIC categories as recorded in CorpTech. Cross-referencing to Compustat identifies 8,510 public firms in CorpTech. This cross-referencing means that our sample includes any firm that has a presence in any of the CorpTech industries, and our analyses to replicate Chang (1996) account for

[3] The CorpTech database increases in number of firms substantially over the first few years, and there are some systematic errors in the data for 1990 that must be corrected. Information is available from the authors. Therefore, we use the data from 1991 forward in our regression analyses.

all of the firms' manufacturing segments reported in Compustat, not just high-tech businesses. Chang (1996) created a balanced panel dataset of 772 manufacturing firms that persisted from 1981 to 1989. Similarly, for our primary replication, we create a balanced panel dataset of 965 manufacturing firms that persist from 1993 to 2001.

Table 1 provides a comparison between data and variables used in this replication and the original (1996) article.

Table 2 reports the number of manufacturing firms in Compustat for each year 1981–2004. As seen in the second column, Chang's balanced sample covers 23–27 percent of the manufacturing firms in Compustat in a given year; whereas, post-1993, our balanced sample covers 22–25 percent of Compustat manufacturing firms (second column), and our unbalanced sample of public manufacturing firms from 1992 to 2001 covers 33–40 percent. In addition, our sample also covers nonmanufacturing firms and private firms, allowing us to examine the evolutionary perspective of diversification beyond the scope of the public manufacturing sector. Another pattern that can be derived from the statistics in Table 2 is that the percent of nonmanufacturing public firms—those without any segment in SIC 2000 or 3000—in CorpTech stays relatively constant over time, ranging between 80 and 85 percent of firms from 1991 to 2004. TRINET had some detailed data coverage that made it superior to CorpTech or Compustat for analysis of diversification, but since it was only available for a few years, our replication for a more recent period uses an alternative data source. To be clear, our replication uses a balanced sample of public manufacturing firms over the same number of years as the Chang (1996) sample, but starting 12 years later (4 years after the end of his sample period). Chang (1996) aggregated TRINET data at the establishment level to the SIC code level; whereas we use SIC codes already in the CorpTech data. After the replication, we investigate the hypotheses for nonmanufacturing and private firms.

Tables 3–5 provide descriptive information on diversification and entry and exit activities during 1993–2001, repeating information from Chang's Tables 1a–c, respectively (1996: 595). Table 3 lists the number of entry and exit activities. Following Chang's (1996) definition of his dependent variables, *extensive search* is entry into a new three-digit SIC industry in which the firm did not previously operate, while *intensive search* is entry into a new four-digit SIC in a three-digit SIC industry in which the firm is currently operating. Table 3a repeats information from Chang's Table 1a, slightly reformatted. For comparison, Table 3b reports on our replication sample, showing that extensive entry outnumbers intensive entry, in line with the finding in Chang (1996). We report annual counts, rather than biannual, in Table 3b. The magnitude of overall entry is similar to that of Chang (1996), but more heavily weighted toward extensive search. The lower incidence of intensive search in our sample could be due to the fact that the establishment-level data in TRINET more fully identifies variety within a three-digit SIC industry. Also, we observe less than half the number of exits per firm in our time window as he had. This is the first indication that the data coverage, external environment, or corporate strategy are different in the later period.

Table 4 lists frequencies of entry and exit. Table 4a repeats Chang's (1996) figures, adding columns for "% of Total" for easier comparison to frequencies in our sample, shown in Table 4b. Results are not precisely comparable since the sample time periods are different. Again we note that exit is much less frequent in the later period: over half of our balanced sample had no exits, whereas only one percent of Chang's sample had no exits. Similarly, nearly two-thirds of our sample had no intensive entries (adding a four-digit SIC code in an industry in which the firm already participates at the three-digit SIC code level), whereas only one-third of Chang's sample had no intensive entries. Table 5a, repeating Chang's (1996) Table 1c, reports firms' average overall level of diversification at the four-digit SIC level. Table 5b shows the same statistics for the CorpTech sample. We cannot compute Berry's Herfindahl index, since CorpTech does not report sales by SIC code, only for the entire firm. To provide some further description, we report the number of CorpTech product markets for the average firm in each year of our sample. Firms in the later period are active in slightly fewer manufacturing industries than in the 1980s, but much less likely to be in nonmanufacturing industries. Thus, along with differences in the propensity to engage in intensive search entry and exit industries, the CorpTech-based sample firms that are present in at least one manufacturing industry also are less diversified into nonmanufacturing industries than the firms in Chang's (1996) sample.

DOI: 10.1002/smj

Table 1. Comparison of replication to original article

Sample	Chang (1996)	Replication
Years	TRINET 1981–1989, biannual data	CorpTech 1993–2001, annual data
Industries	132 manufacturing industries at the four-digit SIC level	230 four-digit SIC manufacturing industries (out of 442 four-digit SIC industries in CorpTech)
Firms	772 that remained active and publicly traded from 1978 to 1991	965 that remained active and publicly traded from 1993 to 2001
Coverage of Compustat	24% of Compustat manufacturing firms	23% of Compustat manufacturing firms
Dependent variables		
Intensive entry	Firm reports a new four-digit SIC in a three-digit SIC in which the firm already is active	Same
Extensive entry	Firm reports a new four-digit SIC not in a three-digit SIC in which the firm is already active	Same
Exit	Firm no longer reports a four-digit SIC that it did report previously	Same
Independent variables		
Relative performance	Lagged aggregated five-year relative performance, the difference between firm ROA and aggregated ROA of all firms in the four-digit SIC industry	Same
Human resource profile (HRP) dissimilarity	Distance between the focal industry and the other industries in which the firm operates, by distribution across OES occupational profiles	Same; some adjustments for changes in OES survey coding and reporting, with robustness checks
Managerial HRP dissimilarity Engineering HRP dissimilarity Scientific HRP dissimilarity Marketing HRP dissimilarity	Distance using percent of employees in managerial, engineering, scientific, and marketing occupation profiles, respectively	Same
HRP dissimilarity from previous entries	Distance between the newly entered industry and industries the firm entered in the previous period	Same
Extensiveness of a firm's previous search activity	The percentage of the firm's extensive search entries among all entries in the previous period	Same
Control variables		
Debt/equity	Long-term debt over market value of equity from Compustat	Same
Current ratio	Current assets over current liabilities from Compustat	Same
Firm size	Log of assets from Compustat	Same
Demand growth	Five-year avg. growth rate of value shipments, 1981–1986, from the Department of Commerce	Same for 1993–1998; Also test one-year rates with year fixed effects
Import competition	Five-year avg. ratio of total imports divided by industry shipments, 1981–1986, from the Department of Commerce	Same for 1993–1998; Also test one-year rates with year fixed effects
Market concentration	Eight-firm concentration ratio of 4-digit SIC industries, as of 1982, from Census of Manufacturing	Same as of 1992 Census of Manufacturing report

Table 1. Continued

Sample	Chang (1996)	Replication
Market share (exit models)	From TRINET line of business data	Not available
Size of business (exit models)	From TRINET line of business data	Not available
Additional variables for robustness extensions		
Clock: Log entry rank	n.a.	The log of the overall order of entry into the focal industry, ranked by the year in which the firm enters a four-digit SIC code, as recorded by CorpTech
Technological diversity	n.a.	One minus the Herfindahl index of concentration of the firm's patents across patent classes in the focal year

Table 2. Compustat coverage in original article and replication

Year	Number of public mfg. companies in Compustat (X)	Chang (1996) public balanced sample coverage (772/X)	CorpTech public balanced mfg. sample coverage (965/X)	CorpTech unbalanced public mfg. sample coverage (Y/X)	Number of public mfg. companies in CorpTech (Y)	Number of all public (mfg. and nonmfg.) companies in CorpTech
1981	2,911	0.27				
1982	3,053	0.25				
1983	3,166	0.24				
1984	3,208	0.24				
1985	3,298	0.23				
1986	3,381	0.23				
1987	3,418	0.23				
1988	3,385	0.23				
1989	3,350	0.23				
1990	3,405					
1991	3,544					
1992	3,743			0.33	1,243	8,285
1993	3,925		0.25	0.34	1,317	8,290
1994	4,062		0.24	0.35	1,409	8,294
1995	4,296		0.22	0.36	1,561	8,302
1996	4,326		0.22	0.37	1,598	8,310
1997	4,272		0.23	0.38	1,603	8,333
1998	4,278		0.23	0.39	1,673	8,343
1999	4,199		0.23	0.39	1,649	8,341
2000	4,035		0.24	0.39	1,592	8,363
2001	3,859		0.25	0.40	1,551	8,396
2002	3,745				1,493	8,397
2003	3,648				1,461	8,392
2004	3,557				1,423	8,394

Variables

Relatedness measures

Chang (1996) followed Farjoun (1990) to use the Occupational Employment Survey (OES) data to create resource relatedness measures based on similarity of occupational profiles among three-digit SIC industries. Replicating Chang's (1996) selection of occupation categories, we define four human resource groups: managerial, engineering, scientific, and marketing. Table 6a reports the summary statistics of the human resource

DOI: 10.1002/smj

Table 3. Entry and exit activity by year for balanced samples of public manufacturing firms

Years	ENTRY (SIC4) All entry	Extensive search	Intensive search	EXIT (SIC4)
(a) Chang (1996) TRINET sample ($N = 772$)				
1981–1983	547	414	133	518
1983–1985	931	638	293	1,033
1985–1987	1,125	707	418	981
1987–1989	1,036	746	290	662
Total	3,639	2,505	1,134	3,194
Per firm avg.	4.70	3.24	1.46	4.13
(b) CorpTech sample ($N = 965$)				
1993	744	626	118	319
1994	416	342	74	103
1995	539	454	85	123
1996	485	412	73	168
1997	503	415	88	244
1998	458	378	80	213
1999	537	447	90	288
2000	361	302	59	261
2001	513	429	84	157
Total	4,556	3,805	751	1,876
Per firm avg.	4.72	3.94	0.78	1.94

Table 4. Frequency of entry or exit for balanced samples of public manufacturing firms

	Extensive search		Intensive search		Exit	
Frequency of entries or exits	# of firms	% of total	# of firms	% of total	# of firms	% of total
(a) Chang (1996) TRINET Sample 1981–1989						
0	35	4.5	261	33.8	7	0.9
1–5	363	47.0	396	51.3	310	40.2
6–10	160	20.7	72	9.3	199	25.8
11–20	117	15.2	43	5.6	157	20.3
21–40	86	11.1	-	0	81	10.5
>40	11	1.4	-	0	18	2.3
Total	772	100%	772	100%	772	100%
(b) CorpTech sample 1993–2001						
0	223	0.23	696	0.72	615	0.64
1–5	582	0.60	241	0.25	275	0.28
6–10	101	0.10	19	0.02	52	0.05
11–20	45	0.05	8	0.01	15	0.02
21–40	10	0.01	1	0.00	8	0.01
>40	4	0.00	0	0.00	0	0.00
Total	965	100%	965	100%	965	100%

measures. The number of covered three-digit SIC industries in the OES survey data is not consistent from year to year, as shown in Table 6b. Before 1999, changes result from increasing industry coverage in the survey from year to year and which SIC codes firms self-report. Then, the occupation codes in the OES were recoded in 1999. Also, OES switched its industry classifications from SIC to NAICS codes in 2002. Due to this major change, we do not include years past 2001. To be sure these changes do not affect our estimation; we recomputed the summary statistics in Table 6a for subsamples during 1988–1995 and 1996–2001. Each period shows similar results as the reported statistics in Table 6a.

The mean and standard deviation of the marketing human resource variable are similar across samples. The mean is higher for our sample than

DOI: 10.1002/smj

Table 5. Overall level of diversification for balanced samples of public manufacturing firms

Year	SIC4 industries	Mfr. industries	Nonmfr. industries	Berry's Herfindahl index
(a) Chang (1996) TRINET sample 1981–1989 ($N = 722$)				
1981	14.16	8.14	6.02	0.544
1983	14.53	8.18	6.35	0.554
1985	14.02	8.03	5.99	0.561
1987	13.65	7.89	5.76	0.562
1989	16.29	7.89	8.40	0.565

Year	SIC4 industries	Mfr. industries	Nonmfr. industries	CorpTech product market
(b) CorpTech sample 1994–2002 ($N = 965$)				
1993	7.40	5.72	1.68	11.77
1994	7.09	5.49	1.60	11.55
1995	7.05	5.37	1.69	11.53
1996	7.32	5.56	1.76	11.92
1997	7.52	5.78	1.74	11.92
1998	7.57	5.88	1.69	12.25
1999	7.67	5.94	1.73	12.02
2000	7.80	5.96	1.84	11.98
2001	7.76	5.95	1.81	11.97

Table 6. Overview of human resource profiles in three-digit SIC industries

Variable	Sample	Mean	*S.D.*	Min	Max	Eng.	Sci.	Mkt.	Mgm.
(a) Summary of human resource profile measures									
1. Engineering human resources	CorpTech	7.05	7.57	0.11	41.54	1.00			
	TRINET	*3.68*	*5.32*	*0*	*31.69*				
2. Scientific human resources	CorpTech	4.15	6.07	0	47.05	0.17	1.00		
	TRINET	*1.44*	*2.01*	*0*	*12.05*	*0.32*			
3. Marketing human resources	CorpTech	2.99	2.07	0.23	14.81	−0.28	0.20	1.00	
	TRINET	*2.56*	*2.06*	*0*	*13.15*	*−0.18*	*0.29*		
4. Managerial human resources	CorpTech	6.83	1.97	3.21	13.26	0.45	0.49	0.42	1.00
	TRINET	*3.59*	*1.60*	*0*	*8.32*	*0.64*	*0.54*	*0.31*	

Year	# of SIC3
(b) Number of three-digit SIC industries included in human resource profile estimation	
1992	147
1993	128
1994	102
1995	147
1996–2001	378

The top number in each cell is the value for our balanced sample from 1993 to 2001. The bottom number in italics under is the value from Chang's Table 2 (1996: 597).
The Occupational Employment Survey (OES) in 1996 is not available, thus the measures are estimated with the average of values in 1995 and 1997.
The occupation codes in the OES were recoded in 1999.

Chang's for the other three types. Also, every three-digit SIC code included in our balanced sample has a nonzero value for engineering, marketing, and managerial human resources, while there were some zero values in the earlier sample. In both samples, the only negative correlation between types occurs for marketing and engineering human resources.

Chang (1996) measured relatedness between entered or exited industries and the firm's remaining portfolio (H2) in two variations: closest distance and average distance. He used the closest distance to capture how firms diversify extensively, and average distance to measure human profile dissimilarity in intensive search and exit models. The human resource percentages are at the three-digit SIC code level. Therefore, since intensive search is defined as entry into a new four-digit industry within an existing three-digit industry, the closest distance always equals zero; and a similar problem would occur for exit from an existing four-digit industry.

Human resource profile dissimilarity. Let X_{ik} be the percentage of type k human resources in industry i, where $k \in \{managerial, engineering, scientific, marketing\}$. In the intensive search model and exit model, we calculate the average distance of human resources among focal industry$i$ and other industries, $j \neq i$, in which the firm operates, where the distance is measured by $|(X_{ik} - X_{jk})|$. Chang (1996) weighted the distances by sales to compute a weighted average distance. In this way, a firm that is primarily operating within the focal three-digit industry would have an average distance measure also close to zero. We do not have sales data, so our average distance is unweighted. Thus, our measure of human resource profile (HRP) dissimilarity in the intensive search model might, compared to Chang's measure, more or less strongly emphasize differences between the focal target four-digit industry and the firm's other businesses outside the three-digit industry in which that target resides. In the extensive search model, we measure dissimilarity as $\left(\min_j \sum_k | \left(X_{ik} - X_{jk} \right) | \right)$,which is the closest distance (in absolute value) between the target industry and any industry in which the firm currently operates.

Human resource profile dissimilarity from previous entries. In the sequential entry model (H3a, H4), we follow Chang (1996) to estimate HRP dissimilarity with the closest distance between the target industry and the industries that a firm entered in the previous period.

Extensiveness of a firm's previous search activity. As defined by Chang (1996), this variable is the ratio of the number of extensive search entries to the number of total entries in the previous period.

Performance measure

Relative performance. We define industry performance as the aggregated performance of all firms that operate in the industry. The relative performance is the gap between firm performance and the average industry performance among industries in which the firm operates. For public firms, we use return on assets (ROA) from Compustat to estimate the relative performance variable on an annual basis; whereas Chang (1996) used five-year averages of both the firm and the industry. For private firms, we use sales from CorpTech.

Control variables

Following Chang (1996), three industry control variables are used in our empirical models. *Demand Growth*: Growth rate of value shipments, 1993–1998, from the Department of Commerce. *Market Concentration*: Eight-firm concentration ratio, as of 1992, from the Census of Manufacturers. *Import Penetration*: The ratio of total imports divided by industry shipments, 1993–1998, from the Department of Commerce. In our extensions beyond the replication, due to an unbalanced panel we use annual data, lagged one year, for demand growth and import penetration.

The following firm-level variables are drawn from Compustat historical and segment data and merged with the CorpTech data using firms' ticker symbols: long-term debt over market value of equity (*Leverage Ratio*); current assets divided by current liabilities (*Liquidity Ratio*); and log of assets (*Firm Size*). For private firms, we measure firm size by log of number of employees. Each is lagged one period from the entry/exit activity. Descriptive statistics and correlations for the variables used in models of entry are given in Table 7.

Chang (1996) used state-based sampling (SBS) to create multiple random samples of nonevents so economically significant relationships would not be lost in the noise of nonevents. The SBS also improves computational efficiency, enabling convergence of the estimation. The dependent variable, Y_{ijt}, is a binomial variable that equals one if firm i enters manufacturing industry j at time t, and zero otherwise. Following his method, we generate nonentry events considering all three-digit SIC manufacturing categories in which a focal firm does not operate, but some sample firm operates in that year. Chang (1996) tested H1, H2a, and H3a using

DOI: 10.1002/smj

Table 7. Variable summary statistics

		Mean	*S.D.*	Min	Max	1	2	3	4	5	6	7	8	9	10	11	12
1	Extensive entry	0.01	0.10	0	1	1.00											
2	Relative performance (ROA) ($t-1$)	−4.45	5.09	−51.7	56.1	0.08	1.00										
3	Demand growth	0.04	0.05	−0.10	0.29	0.01	0.13	1.00									
4	Import competition	0.18	0.18	−0.48	0.89	0.01	0.03	−0.06	1.00								
5	Market concentration	52.55	22.37	0	95	−0.03	−0.13	−0.11	−0.02	1.00							
6	Firm size ($t-1$)	4.66	2.15	−3.04	10.62	0.10	0.35	0.00	0.00	0.01	1.00						
7	Debt/equity ($t-1$)	0.24	0.80	0	17.28	0.00	−0.02	0.00	0.00	0.00	0.01	1.00					
8	Current ratio ($t-1$)	3.64	3.81	0.05	49.40	−0.03	−0.10	−0.01	0.00	0.00	−0.21	−0.12	1.00				
9	Human resource profile dissimilarity	16.38	15.15	0	89.35	−0.06	−0.09	0.07	−0.01	0.08	−0.16	−0.08	0.15	1.00			
10	Managerial	2.06	2.16	0	18.45	−0.05	−0.10	−0.11	−0.01	0.04	−0.14	−0.05	0.07	0.52	1.00		
11	Engineering	5.97	6.73	0	54.91	−0.05	−0.10	−0.04	0.00	0.07	−0.10	−0.07	0.04	0.57	0.26	1.00	
12	Scientific	7.00	11.10	0	47.91	−0.04	−0.03	0.14	0.00	0.04	−0.11	−0.05	0.15	0.85	0.30	0.09	1.00
13	Marketing	1.35	1.41	0	9.98	−0.05	−0.10	0.01	−0.10	0.13	−0.14	−0.08	0.10	0.53	0.48	0.18	0.40

Extensive search for balanced sample of public manufacturing firms; N = 965; all variables as used in Table 8, Model 3. Correlation matrices for other regression models available upon request from the authors.

logit models. We do the same, but adjust standard errors by clustering observations by firm. Regarding sequential entry, he again estimated a logit model to compare the direction of extensive entry with the knowledge applicability of previous entries. We do the same, but our sample has a much larger proportion of nonevents than Chang's (1996) sample. The number of nonevents in the models with lagged extensive/intensive ratio is limited by the number of firms that conducted entry in the past, and most of our firms do not enter in multiple successive years, let alone spanning a stretch of six years. Therefore, rather than report separate results for each two-year time period, as in Chang's (1996) Table 4, we pool all observations that have the required lags in each column. Also, since he had biannual data, a one-period lag (i.e., $t-1$) represented a difference of two years; whereas since we have annual data, we specify a one-period lag as one year. These changes are necessary to yield sufficient sample size to test the hypotheses about sequential entry. Unfortunately, we do not have enough observations with values for lagged extensive/intensive ratio to test Hypothesis 4 (H4), part (2), about accumulated extensive entry.

RESULTS

Chang's (1996) first set of Hypotheses (H1a, H2a, H3a) address market entry, tested with logit models. For direct comparison to Chang (1996), Table 8 includes only our balanced sample of public manufacturing firms. Contrary to H1a, there is no effect of Relative performance (lagged ROA) on extensive entry. Chang (1996) also found no effect for this relationship. Relative performance does have a positive and statistically significant effect in Model 5 on intensive search, but this is not robust to the more detailed specification in Model 6. H2a states that firms will be more likely to enter industries that have similar human resource profiles as the firm's existing businesses. As this hypothesis predicts, HRP dissimilarity has a negative coefficient ($\beta = -0.049$; p-value < 0.001) for extensive entry (column 2). A change in HRP dissimilarity from 1 standard deviation (*S.D.*) above the mean to 1 *S.D.* below the mean increases the predicted value of extensive search entry by 1.5 percent. Turning to Model 3, Chang (1996) found statistically significant effects for managerial, scientific, and marketing human resource dissimilarity, but not engineering. In comparison, we find effects for the engineering, scientific, and marketing variables with slightly lower p-values (i.e., stronger statistical significance) than those reported by Chang (1996). The most influential factor is marketing dissimilarity: a change from 1 *S.D.* above the mean to 1 *S.D.* below the mean increases the predicted value of the dependent variable by 0.9 percent.

Chang (1996) does not report descriptive statistics for the human resource profile variables. Therefore, we cannot estimate marginal effects for his

DOI: 10.1002/smj

Table 8. Logit models of entry for balanced sample of public manufacturing firms

	Extensive search			Intensive search		
	(1)	(2)	(3)	(4)	(5)	(6)
Intercept	0.627	−0.957	−0.847	1.527	0.334	−0.734
	(0.224)	(0.324)	(0.331)	(1.248)	(1.333)	(1.366)
Relative performance (ROA) (*t* – 1)	−0.015	0.207	0.188	0.676	1.541	1.385
	(0.099)	(0.341)	(0.332)	(0.610)	(0.697)	(0.931)
Human resource profile dissimilarity		−0.049			0.066	
		(0.009)			(0.032)	
Managerial			0.013			0.592
			(0.061)			(0.191)
Engineering			−0.058			0.095
			(0.017)			(0.081)
Scientific			−0.035			0.068
			(0.012)			(0.073)
Marketing			−0.272			−0.940
			(0.064)			(0.317)
Debt/equity (*t* – 1)	0.175	−0.003	−0.007	2.928	2.849	2.804
	(0.085)	(0.078)	(0.081)	(1.414)	(1.296)	(1.438)
Current ratio (*t* – 1)	−0.033	−0.027	−0.021	0.301	0.253	0.304
	(0.015)	(0.027)	(0.026)	(0.148)	(0.125)	(0.172)
Firm size (*t* – 1)	0.193	0.343	0.336	0.290	0.180+	0.213
	(0.029)	(0.041)	(0.040)	(0.108)	(0.106)	(0.121)
Demand growth	6.498	4.408	4.231	3.078	5.836	7.129
	(0.898)	(1.285)	(1.267)	(3.956)	(4.680)	(3.299)
Import competition	1.157	1.092	0.971	−0.050	0.141	−0.095
	(0.254)	(0.326)	(0.332)	(1.235)	(1.255)	(1.299)
Market concentration	−0.019	−0.013	−0.012	−0.029	−0.027	−0.018
	(0.002)	(0.003)	(0.003)	(0.014)	(0.013)	(0.012)
Observations	3,645	1,878	1,878	623	480	480
Events	2,725	965	965	597	454	454

Standard errors appear in parentheses under the coefficients. All models include clustering by firm and state-based sampling. Following Chang (1996), Models 1–3 use the minimum distance measure of dissimilarity; Models 4–6 the average distance measure.

study to compare to ours. Comparing our estimated coefficient of -0.05 for overall HRP dissimilarity to his estimated coefficient of -0.07 might seem to suggest the magnitude and direction of our effect is comparable to that found in Chang's (1996) study; but, in a nonlinear model such as the logit specification, marginal effects depend on the values of other variables in the sample, so this comparison would not be definitive.

Regarding H2a for intensive search, we fail to reproduce Chang's (1996) finding of a negative relationship between human resource dissimilarity and the likelihood of entering any new four-digit SIC category within the same three-digit SIC industry (Table 8, Model 5). Breaking down the measure of knowledge applicability into its four components reveals that marketing dissimilarity is the only one with the predicted, negative effect; whereas Chang (1996) found significant negative relationships between managerial and scientific human resource dissimilarity and intensive search. For our sample, managerial dissimilarity has a strong positive effect on intensive search entry.

It is important to note that the majority of our sample firms had no intensive entry in the sample period, whereas only about one-third of Chang's firms had no intensive entry. This means our estimation involves mostly firms that do not enter any new four-digit SIC code within an existing three-digit SIC industry, so there is little within-firm variation in the dependent variable. Differences in the samples are also revealed by the fact that the controls for debt/equity and current ratio, and the measure of relative performance all have statistically significant effects in our models, whereas they did not in Chang's (1996) sample. It is possible that his hypotheses no longer hold in the later period because firms had fewer opportunities remaining to expand into new markets within their existing industries, having already pursued such related

DOI: 10.1002/smj

diversification during the earlier period. Yet it is also possible that sample selection issues arising from the use of CorpTech rather than TRINET drive the difference in results. In general, we find support for the importance of knowledge applicability in extensive search and somewhat in intensive search. These results are in line with Chang's (1996) overarching theory that diversification decisions are path dependent, based on the firm's knowledge base.

Hypotheses 3a and 4 address sequential entry. Table 9 gives the estimation results of our sequential entry models. Here, we opt to report results without state-based sampling, although employing SBS yields nearly identical results. H3a posits that firms will enter industries that are similar to those it has recently entered. The critical estimate for H3a is the coefficient for HRP dissimilarity with the firm's entries at time (t – 1). The negative effect (β = -0.044 in column 2; p-value < 0.001) matches the finding of Chang (whose coefficient was -0.04), consistent with H3a. As described above, our sample has a larger proportion of nonevents than Chang's (1996) sample because intensive entry is less frequent. This difference does not seem to bias the coefficients downward. Regarding H4, part (1), which states that past extensive search encourages extensive search in the focal time period, we find a significant coefficient for extensiveness of search at the two-year lag, while Chang (1996) found significant effects for the two-year lag and also lags at four and six years. Overall, we interpret our results as confirming Chang's, although our lag structure does not go as far back, and our sample includes a much higher percentage of extensive entry. Since our lagged measures are not as extensive or robust as those in the original paper, our support for H3a is weaker.[4] We do not test H4, part (2), about the accumulated extensive entry prior to the focal period, because of data limitations. Chang (1996) found no support for that hypothesis.

Chang's (1996) second set of Hypotheses (H1b, H2b, H3b) address market exit. Econometrically, he estimated a Cox hazard model for the likelihood of exit from all markets in which a firm operates. Table 10 presents comparable models for our sample. We include the same control variables as in Chang (1996) except for line of business characteristics, which are not available in CorpTech. H1b proposes that poor performance will make firms more likely to exit a market. Indeed, relative performance has a significant negative effect, consistent across model specifications using public firms in columns 1–5, in agreement with H1b and Chang's (1996) findings. Moreover, there is a significant effect of knowledge applicability, as measured by HRP dissimilarity, offering support for H2b. HRP dissimilarity of a market with the rest of the firm's portfolio is positively correlated with exit from that market, seen in the second column (β = 0.021; p-value < 0.001). This effect is evident for managerial and engineering human resources (Table 10, column 3). As noted by Chang (1996), the hazard rate involves not only the likelihood of exit but also its ordering in time. Thus, H3b is also supported by the finding for HRP dissimilarity.

DISCUSSION AND EXTENSIONS

The replication corroborates many of Chang's (1996) findings. Consistent with Chang (1996), we find that poor performance leads to higher probability of exit in the next period (H1b), although not lower probability of entry (neither study finding support for H1a). In our sample from later years, public manufacturing firms continue to enter new three-digit SIC industries that employ similar human resources as the firm's existing portfolio of businesses (H2a), demonstrating path dependence for knowledge search. Also, firms tend to exit those businesses that are most dissimilar to the rest of the portfolio (H2b). These patterns are further replicated in the sequence of entries (H3a, H4a) and exits (H4a, H4b) over multiple periods. The key differences in our findings are that intensive entry and exit are less frequent for our sample than Chang's (1996) sample, and we do not find support for H2a when considering intensive entry.

Building on the replication, we extend and confirm Chang's (1996) contribution in two ways. First, we introduce new variables to test additional aspects of the relationship between market entry and exit. Second, we report on the dynamics of diversification among all public firms—including nonmanufacturing public firms—and all private firms.

Robustness of results to inclusion of additional controls

Exit is not simply a way to change the product portfolio, it may also imply poor performance.

[4] We thank an anonymous reviewer for clarifying this point about the test of H3a given the H4-related variables.

Table 9. Logit models of entry: sequential extensive search for balanced sample

	(1)	(2)	(3)	(4)
Intercept	−5.242	−5.161	−10.038	−19.144
	(0.284)	(0.512)	(1.969)	(9.202)
Relative performance (ROA) (t – 1)	0.705	0.173	−0.182	−1.753
	(0.489)	(0.388)	(0.334)	(1.418)
Human resource profile dissimilarity (t) (min. dist.)	−0.058			
	(0.008)			
HRP dissimilarity with firm's entries at time (t – 1)		−0.044	−0.065	−0.094
		(0.011)	(0.017)	(0.052)
Extensive/intensive ratio at time (t – 1)		−0.178	0.566	−0.644
		(0.246)	(0.507)	(1.361)
Extensive/intensive ratio at time (t – 2)			2.333	2.635
			(0.791)	(3.241)
Extensive/intensive ratio at time (t – 3)				6.986
				(7.986)
Debt/equity (t – 1)	−0.124	−0.373	−1.418	−9.835
	(0.181)	(0.225)	(0.810)	(4.074)
Current ratio (t – 1)	−0.024	−0.125	−0.086	−0.362
	(0.027)	(0.067)	(0.221)	(0.445)
Firm size (t – 1)	0.314	0.322	0.649	1.594
	(0.037)	(0.052)	(0.159)	(0.518)
Demand growth	1.904	1.106	1.885	−4.634
	(0.872)	(0.903)	(1.417)	(3.327)
Import competition	0.427	0.465	0.715	−0.606
	(0.174)	(0.219)	(0.351)	(0.323)
Market concentration	−0.009	−0.010	−0.002	−0.005
	(0.002)	(0.002)	(0.003)	(0.006)
Observations	87,811	70,368	17,492	4,276
Events	965	640	199	68
Pseudo R^2	0.106	0.090	0.223	0.570

Standard errors appear in parentheses under the coefficients. All models include clustering by firm.

Mitchell (1991) theorizes that some firms are more sensitive than others to respond to external opportunities. Thus, the earliest entries to a market better capture the opportunities and are more likely to turn those opportunities into profits. Firm survival is an important indicator of performance. Mitchell (1991) develops hypotheses specifically related to entry into industry subfields, not broad industries, and distinguishes between entry by industry newcomers and industry incumbents. However, the logic may apply to firms using market entry as a search mechanism: those that enter early gain learning advantages over later entrants. Similarly, Agarwal (1996) finds that firms that enter technological areas during early stages of high activity survive longer than firms that enter after the market has matured. In terms of an exit model, then, this research implies that the earlier an entrant enters the industry, the lower its likelihood of eventual exit.

Thus, we test the path-dependent hypothesis controlling for the possibility (Mitchell, 1991) that early response to external opportunities drives the decision in exiting product markets. In Columns 4 and 5 of Table 10, *Clock: Log entry rank* provides a test of entry order effects. As proposed, entry rank (later entry is a higher value) is positively associated with hazard of exit, with statistical significance at the highest confidence level. Therefore, a firm survives better if it is an early entrant to the industry. Nevertheless, the effects of relative performance and the average HRP dissimilarity measures remain significant even controlling for entry rank. Thus, Chang's (1996) result about firm evolution is robust even when controlling for an aspect of industry evolution.

A limitation of Chang's (1996) measurement is that industry-average profiles of human resources are imputed to firms. Later research on market entry and diversification proposes that patent data reflects knowledge that can be measured at the firm level (e.g., Miller, 2006; Silverman, 1999). In Table 11, we test robustness of Chang's (1996) findings about

Table 10. Hazard models of exit for manufacturing firms

	Public firms balanced sample					Private balanced
	(1)	(2)	(3)	(4)	(5)	(6)
Relative performance (t – 1)	−0.096	−0.096	−0.092	−0.093	−0.089	0.001
	(0.040)	(0.040)	(0.041)	(0.039)	(0.040)	(0.003)
Human resource profile dissimilarity		0.021				
		(0.006)				
Managerial			0.073		0.056	0.005
			(0.023)		(0.024)	(0.004)
Engineering			0.024		0.026	0.008
			(0.010)		(0.010)	(0.001)
Scientific			0.012		0.010	0.018
			(0.009)		(0.010)	(0.001)
Marketing			−0.006		0.040	0.049
			(0.051)		(0.049)	(0.010)
Clock: Log entry rank				0.246	0.572	0.079
				(0.104)	(0.210)	(0.008)
Debt/equity (t – 1)	−0.030	−0.035	−0.052	−0.041	−0.085	
	(0.071)	(0.079)	(0.085)	(0.074)	(0.093)	
Current ratio (t – 1)	−0.011	−0.014	−0.013	−0.013	−0.014	
	(0.021)	(0.025)	(0.025)	(0.022)	(0.026)	
Firm size (t – 1)	0.046	0.036	0.044	0.045	0.037	0.216
	(0.023)	(0.028)	(0.029)	(0.023)	(0.029)	(0.004)
Demand growth	−0.253	−0.170	−0.167	0.018	0.293	0.164
	(0.251)	(0.267)	(0.271)	(0.233)	(0.229)	(0.071)
Import competition	−0.035	−0.030	−0.056	−0.083	−0.075	−0.017
	(0.118)	(0.130)	(0.130)	(0.114)	(0.125)	(0.034)
Market concentration	0.003	0.002	0.002	0.003	0.002	0.004
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.001)
Observations	27,477	23,144	23,144	27,477	23,144	185,832
Failure events	1,663	1,420	1,420	1,663	1,420	14,626

Standard errors appear in parentheses under the coefficients. In Model 6, for the balanced sample of private manufacturing firms, relative performance is measured as total sales, and firm size as total number of employees.

human resource profiles while controlling for a variable created from firms' patent portfolios in later research. All patent information comes from the National Bureau of Economic Research (NBER) patent database, which covers many large, public firms. *Technological Diversity* is a Herfindahl index of the dispersion of the firm's patents across classifications (Garcia-Vega, 2006; Hall, Jaffe, and Trajtenberg, 2001), closely related to other measures of technological diversity: a concentric index (Argyres, 1996), an entropy index (Miller, Fern, and Cardinal, 2007), or the coefficient of variation of the revealed technology advantage index (e.g., Cantwell and Piscitello, 2000). We count the number of a firm's patents in each International Patent Classification (IPC) at time t and compute the index as 1- $\sum_i P_i^2$; where P_i is the proportion of a firm's patents in class i at time t. This is a firm-level control that does not change depending on the focal industry. A firm with greater technological diversity is more likely to enter additional industries (Miller, 2004) and may be less likely to exit lines of business, because it has opportunities to recombine knowledge in different ways (Miller *et al.,* 2007). When the firm is not covered in the NBER database, we impute a zero value for patents, and the control variable No Patent Data is set to equal one (zero otherwise). As reported in Table 11, Technological Diversity has a strong positive effect on entry and negative effect on exit, yet results for HRP dissimilarity and its components remain robust.[5]

Evidence on public nonmanufacturing firms and private firms

A benefit of our sample is that it includes public firms that do not participate in manufacturing industries and private firms, which account for

[5] We also attempted to replicate Silverman's (1999) measure of technological overlap using patent classes. However, due to missing data, there were so few observations that the models would not converge.

Table 11. Models of entry and exit controlling for firm technology portfolio for balanced sample

	(1) Extensive search	(2) Intensive search	(3) Sequential ext. search	(4) Hazard model of exit
Intercept	−11.737	−8.329	−11.871	
	(3.330)	(2.399)	(2.883)	
Relative performance (ROA) (t – 1)	0.738	1.259	0.174	−0.101
	(0.499)	(0.788)	(0.389)	(0.038)
Human resource profile dissimilarity				
Managerial	−0.033	1.286		0.054
	(0.055)	(0.090)		(0.022)
Engineering	−0.060	−0.106		0.029
	(0.013)	(0.023)		(0.010)
Scientific	−0.035	0.066		0.014
	(0.011)	(0.014)		(0.009)
Marketing	−0.318	−0.951		−0.019
	(0.058)	(0.150)		(0.049)
HRP dissimilarity with firm's entries at time (t – 1)			−0.044	
			(0.011)	
Extensive/intensive ratio at time (t – 1)			−0.178	
			(0.246)	
No patent data (assumed 0)	6.688	3.978	6.712	−1.325
	(3.314)	(2.388)	(2.894)	(0.618)
Technological diversity	8.471	4.903	8.633	−2.020
	(4.013)	(2.979)	(3.332)	(0.809)
Debt/equity (t – 1)	−0.153	0.183	−0.376+	−0.037
	(0.190)	(0.052)	(0.226)	(0.080)
Current ratio (t – 1)	−0.023	−0.117	−0.125+	−0.007
	(0.026)	(0.202)	(0.067)	(0.024)
Firm size (t – 1)	0.302	0.031	0.321	0.041
	(0.036)	(0.029)	(0.052)	(0.028)
Demand growth	1.712	4.718	1.076	−0.080
	(0.871)	(1.346)	(0.907)	(0.233)
Import competition	0.347	−0.478	0.469	−0.075
	(0.176)	(0.391)	(0.220)	(0.128)
Market concentration	−0.009	−0.015	−0.010	0.002
	(0.002)	(0.003)	(0.002)	(0.002)
Observations	87,811	3,206	70,368	23,144
Events	965	454	640	1,420

Standard errors appear in parentheses under the coefficients.

much of market entry and exit behavior. Since Chang's (1996) theory centers on evolution through the search for and selection of knowledge, we consider that it should apply to private firms as well as public firms, and knowledge applicability should matter in nonmanufacturing settings. Even if there are important contingencies—for example, that only large private firms can afford to behave like public firms; or that family-owned private firms might have different expectations for business unit performance—overall, there are many more private firms than public firms and private firms account for more entry and exit events than public firms. Of the 3,082 events coded as intensive search from 1993 to 2001, and having enough information for the baseline regression model, only 598 of them are conducted by public firms. Therefore, to see whether Chang's theory does hold for private firms is important. Our exploratory analysis does not reveal whether different effects across types of firms are because nonmanufacturing or private firms have different characteristics (e.g., size and diversification, see Table 1a) or different governance than in public manufacturing firms.

Given so many observations for private firms, we focus our analysis of private firm entry on

DOI: 10.1002/smj

intensive search, which is less frequent than extensive search, and involves fewer nonevents. Table 12 reports models of intensive search for both nonmanufacturing public and all private firms. For these extensions, we also change some of Chang's methodology. Each model's sample is the unbalanced, annual panel, with year dummies, clustering by firm, and no state-based sampling. For private firms, we drop the financial controls and measure firm size in terms of employees rather than assets. The public manufacturing sample includes all firms that ever had a business in SIC codes 2 or 3, but we now include their nonmanufacturing activities. In the replication, if a manufacturing firm had a subsidiary in a nonmanufacturing industry, it was ignored; and only entries into manufacturing industries were considered.[6]

Columns 1 and 2 of Table 12 repeat the analysis from Table 8 for the full, unbalanced sample of public firms. For public manufacturing firms, HRP dissimilarity has a negative effect, primarily in terms of managerial human resources, similar to the findings for the balanced sample and close replication of Chang's methodology. Thus, when public firms enter additional markets within the same industry (i.e., SIC4 in the same SIC3), they primarily enter markets in which managerial human resources are similar. However, for the unbalanced manufacturing sample, the signs for engineering and marketing dissimilarity turn positive. In other words, once we incorporate the firms' activity in nonmanufacturing industries, we see firms will enter new four-digit SIC markets (within familiar three-digit SIC industries) that use less engineering and more marketing resources than the average for their existing businesses. However, they continue to enter markets that have similar profiles in terms of managerial and scientific human resources, and this similarity effect dominates. There are very few observations for public firms that have no manufacturing divisions, but the negative overall effect of HRP dissimilarity remains even for these firms, and using our alternative methodology.

The private firms show a similar effect of overall HRP dissimilarity as the public firms, both for private manufacturing firms (column 5 of Table 12) and private nonmanufacturing firms (column 6). However, differences between the models for public and private firms are revealed when breaking down human resource dissimilarity into its four components. For private manufacturing firms, the effects of managerial and engineering knowledge applicability are as Chang (1996) predicted. Marketing human resources have a strong positive effect on intensive search, echoing the result for the public manufacturing firms using our alternate methodology (column 2); yet rather than engineering human resources having a positive coefficient, it is scientific human resources that have a positive effect for private firms. This difference is possibly because public firms and private firms are distributed differently across industries that are more or less engineering-centered versus science-centered. Nevertheless, the results imply that private manufacturing firms tend to enter additional markets within the same industry that have dissimilar scientific and marketing human resource profiles. To be clear, the measures based on OES data do not distinguish between fields of science (engineering), so we cannot draw conclusions about intensive search for new scientific (engineering) knowledge for innovation. Instead, private firms that are high in the percentage of scientists (or marketers) among their employees are more likely to enter related markets that are lower in the percentage of scientists (or marketers), and vice versa. Intensive market entry (e.g., within-industry diversification) for private firms—perhaps smaller, younger firms than are typically included in management studies of diversification—may be primarily aimed toward commercialization of inventions or acquiring new basic science to fit with the firm's strengths in managerial and marketing knowledge. Private nonmanufacturing firms exhibit a different pattern altogether. Here, the effect of managerial dissimilarity is positive and marketing dissimilarity is negative. The nonmanufacturing firms tend to enter new, closely related industries that are similar in their marketing intensity, but that use a different proportion of managers. This is the same pattern observed for public manufacturing firms in the balanced sample, replicating Chang's methodology as closely as possible (Table 8, column 6).

Our interpretation of the private firm models is that human resource dissimilarity matters to entry and exit for all types of firms, but the effects depend somewhat on sample selection. In particular, different kinds of human resources matter more

[6] This methodological choice of Chang (1996) to only investigate entry into manufacturing SIC codes is made clear by comparing his description of the construction of nonentry events (1996: 600) and his Table 1a.

DOI: 10.1002/smj

Table 12. Logit models of intensive search entry for nonmanufacturing and private firms

	Public manufacturing unbalanced sample		Public non-manufacturing unbalanced sample		Private manufacturing unbalanced sample		Private non-manufacturing unbalanced sample	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Intercept	−4.9614	−4.9198	−4.8648	−4.7736	−4.3520	−4.3571	−3.2194	−3.1595
	(0.2477)	(0.2453)	(0.8903)	(0.8947)	(0.1100)	(0.1090)	(0.1686)	(0.1711)
Relative performance (ROA) (t – 1)	0.0725+	0.0861	0.2329	0.2646	0.0529	0.0516	0.1372	0.1381
	(0.0396)	(0.0411)	(0.2960)	(0.3051)	(0.0111)	(0.0107)	(0.0175)	(0.0178)
Human resource profile dissimilarity	−0.0175		−0.0273		−0.0145		−0.0102	
	(0.0045)		(0.0127)		(0.0021)		(0.0047)	
Managerial		−0.1854		−0.0813		−0.2166		0.1430
		(0.0288)		(0.0820)		(0.0156)		(0.0615)
Engineering		0.0368		−0.0342		−0.0334		−0.0213
		(0.0093)		(0.0244)		(0.0040)		(0.0148)
Scientific		−0.0275		−0.0155		0.0246		0.0016
		(0.0088)		(0.0241)		(0.0042)		(0.0093)
Marketing		0.1234		0.0180		0.2248		−0.2672
		(0.0564)		(0.1523)		(0.0323)		(0.0666)
Debt/equity (t – 1)	−0.4316	−0.4010	−0.1480	−0.1243				
	(0.1991)	(0.1978)	(0.2450)	(0.2307)				
Current ratio (t – 1)	−0.0256	−0.0253	−0.0159	−0.0171				
	(0.0189)	(0.0185)	(0.0629)	(0.0644)				
Firm size (t – 1)	0.1921	0.1816	0.1402	0.1419	0.1242	0.1633	0.1345	0.1432
	(0.0299)	(0.0286)	(0.0959)	(0.0921)	(0.0177)	(0.0186)	(0.0226)	(0.0228)
Demand growth	3.4793	3.9701	3.4557+	3.2514	2.3183	1.7611	0.7188	0.7771
	(0.6606)	(0.6543)	(2.0971)	(2.0415)	(0.5170)	(0.5046)	(0.8454)	(0.8320)
Import competition	−0.1832	−0.1427	0.2150	0.1858	0.3388	0.3355	−0.0854	−0.1750
	(0.3281)	(0.3325)	(0.8288)	(0.8448)	(0.1709)	(0.1695)	(0.2987)	(0.2969)
Market concentration	−0.0088	−0.0095	−0.0126	−0.0129	−0.0150	−0.0164	−0.0125	−0.0133
	(0.0018)	(0.0018)	(0.0080)	(0.0082)	(0.0012)	(0.0012)	(0.0019)	(0.0020)
Observation	60,473	60,473	10,260	10,260	444,421	444,421	42,643	42,643
Events	544	544	54	54	3,524	3,524	773	773

Standard errors appear in parentheses under the coefficients.

to the decisions of nonmanufacturing firms than those of manufacturing firms, which is only evident when looking at private firms, because there are too few public nonmanufacturing firms to estimate effects reliably. Chang's (1996) general story of evolutionary development of diversified firms bears out for private firms, but there are circumstances in which firms seek out new business opportunities that have dissimilar human resource profiles.

The exit behavior of private firms is included in column 6 of Table 10. The sample for this model is the set of private firms matching the criteria for the balanced sample of public manufacturing firms. With a much higher sample size than the previous models of exit, results are consistent with the estimated effects for public firms. The coefficients for engineering, scientific, and marketing HRP dissimilarity are all statistically significant and positive. The slightly smaller magnitude of coefficients is due to the greater proportion of nonevents in the sample, given the number of firms and inclusion of both manufacturing and nonmanufacturing industries. Economic impact is similar to the public firm models, with greater statistical significance due to the increased power of the test. For the private firms, managerial HRP dissimilarity has no effect.

Of course, there may be less variance in managerial HRP dissimilarity for the private firms, since they operate in fewer industries than public firms. These results hold even with the control variables for Clock: Log entry rank, Firm Size, Demand Growth, and Market Concentration all showing increased explanatory power compared to the exit models for the public firms.

CONCLUSION

We replicated the methodology of Chang (1996) with a newer dataset and additional controls to investigate the dynamics of market entry and exit by diversified firms. Consistent with prior results, we found that firms tend to enter markets that have similar human resource profiles as their existing businesses, and to exit markets that have dissimilar human resource profiles. Chang's (1996) hypotheses about "knowledge applicability" (i.e., human resource similarity) across markets generally hold for a later period, many more industries, and both public and private firms. These findings are confirmed in models adding variables to test additional aspects of the relationship between market entry and exit. We document two important patterns beyond the findings of Chang (1996). First, private firms account for the majority of entry and exit events, and even though they tend to be smaller and less diversified than public firms, they follow similar diversification logic. An exception is that private firms pursue within-industry diversification (intensive search) into markets that have different emphasis on scientific human resources. Therefore, further study on the dynamics of diversification in private and small firms is warranted. Second, using finer-grained definitions of product markets than the typical SIC categories, we observe that market entry and exit are frequent phenomena, and many firms do both within short periods of time, even within one year. Thus, as Chang (1996) suggested, a resource-based or capabilities-based view of diversification should incorporate both acquisitions and divestitures, both entry and exit, in the same theory and empirical models.

Limitations of this study provide opportunities for further research and extensions of Chang's (1996) theories and tests. First, the CorpTech data is only for U.S. firms, and only records the products they sell in the United States. The dynamics of diversification certainly entail both product market and international diversification (e.g., Hitt, Hoskisson, and Kim, 1997). Second, while we can measure some aspects of market entry and exit for private firms, more detailed data would certainly offer greater insights, whether focused on smaller, entrepreneurial private firms (e.g., Wu and Knott, 2006) or larger private firms, including business groups (e.g., Chang and Hong, 2000). Third, we did not attempt to incorporate multiple aspects of relatedness among businesses in our estimation. Chang's (1996) and our method followed Farjoun (1990), who later considered both skill relatedness and physical asset relatedness (Farjoun, 1998), finding important interactions between them for firm performance. Various types of resource relatedness may be sufficient, when combined with transaction costs, to induce firms to consider expanding their scope into new markets. Thus, their effects should ultimately be considered simultaneously. Knowledge of customers, shared technology, brand, and other factors have also been cited to explain diversification (e.g., Markides and Williamson, 1994; Robins and Wiersema, 1995; Silverman, 1999). Some of these resources should be expected to influence extensive search into entirely new industries, while other resources may be more relevant to decisions about adding to a firm's product line within an industry, or reallocating resources from one business to another (Sakhartov and Folta, 2014). Even the definition of fungibility and scalability of resources (Levinthal and Wu, 2010) might differ depending on whether one is considering broader or narrower definitions of markets. Fourth, while patents only reveal some aspects of firm knowledge, an extensive literature has used them to examine how industries and firms compare. Future samples might include sufficient firms to construct relatedness measures such as technological overlap (Silverman, 1999).

We found similar patterns as Chang (1996) for extensive entry and sequential entry; whereas intensive entry and exit were much less frequent in the decade after his sample period, according to our data. Future research could investigate the reasons for highly related versus only somewhat related diversification, specifically concerning the firm's pursuit of knowledge-based advantages. Precise categorization of product markets, rather than reliance on SIC or NAICS codes, would be necessary (e.g., Villalonga, 2004). Our results also suggest that private manufacturing firms differ from public manufacturing firms in how they leverage scientific and engineering knowledge. Incorporating private manufacturers into future research could shed light on the relative importance of basic vis-à-vis applied research, the composition of inventor teams, and the goals of acquisitions for smaller, private firms.

Another major opportunity for further research is to develop theories of diversification that include both firm-level and industry-level dynamics. At the firm level, the age and development of the firm matter to entry and exit. One possibility is that firms become "imprinted" with certain corporate strategies (e.g., acquisitions versus alliances or diversification to leverage distribution systems) early in their history, and this imprinting affects later decisions. If so, studies of diversification that include only large, highly diversified public firms may find spurious correlations between drivers of diversification and firm behavior and performance. Also, entry and exit are path dependent; the sequence and frequency with which a particular firm restructures in these ways affect future opportunities. Some notable recent models of firm dynamics (de Figueiredo and Silverman, 2007; Moreno-Badia, Miranda, and Van Beveren, 2008; Wu, 2013) do not explicitly consider how recent behavior affects current decisions; for instance, whether a firm is more likely to enter a new product market if it has recently reduced the size of its product portfolio. Also, industry evolution (Audretsch, 1995) can be built into theories of firm diversification decisions more explicitly. Changes occur in industries due to shifts in demand (Jovanovic, 1982; Klepper, 1996). Penrose described industry demand as an "inducement" to enter a market (Penrose, 1959; Sakhartov and Folta, 2015). An emerging literature is swinging the pendulum back toward external drivers of value dynamics in strategy (e.g., Adner, 2002; Adner and Zemsky, 2006; Priem *et al.,* 2012). Therefore, theories that integrate firm-level and industry-level factors hold promise for expanding our understanding of corporate strategy. For example, de Figueiredo and Kyle (2006) study the interaction between industry evolution and product changes, analyzing the level of competition in a market, firm market share, and firm innovative capability to explain entry and exit separately. While they consider firm heterogeneity, the dynamics are only at the industry level. In contrast, Wu (2013) emphasizes the firm level, investigating the effect of a firm's preexisting capabilities on its decision to diversify in subsequent periods. One exemplar of research that considers dynamics at both levels is de Figueiredo and Silverman (2007).

REFERENCES

Adner R. 2002. When are technologies disruptive? A demand-based view of the emergence of competition. *Strategic Management Journal* **23**(8): 667–688.

Adner R, Zemsky P. 2006. A demand-based perspective on sustainable competitive advantage. *Strategic Management Journal* **27**(3): 215–239.

Agarwal R. 1996. Technological activity and survival of firms. *Economic Letters* **52**: 101–108.

Agarwal R, Gort M. 2002. Firm and product life cycles and firm survival. *American Economic Review* **92**: 184–190.

Alvarez SA, Barney JB. 2007. Discovery and creation: alternative theories of entrepreneurial action. *Strategic Entrepreneurship Journal* **1**: 11–26.

Ansoff HI. 1957. Strategies for diversification. *Harvard Business Review* **35**(5): 113–124.

Argyres N. 1996. Capabilities, technological diversification, and divisionalization. *Strategic Management Journal* **17**(5): 395–410.

Audretsch DB. 1995. *Innovation and Industry Evolution*. MIT Press: Cambridge, MA.

Barney JB. 1986. Strategic factor markets: expectations, luck and business strategy. *Management Science* **32**(10): 1231–1241.

Berger PG, Ofek E. 1995. Diversification's effect on firm value. *Journal of Financial Economics* **37**: 39–65.

Bernard AB, Redding SJ, Schott PK. 2010. Multiple-product firms and product switching. *American Economic Review* **100**(1): 70–97.

Bettis RA. 1981. Performance differences in related and unrelated diversified firms. *Strategic Management Journal* **2**(4): 379–393.

Campa JM, Kedia S. 2002. Explaining the diversification discount. *Journal of Finance* **57**: 1731–1762.

Cantwell J, Piscitello L. 2000. Accumulating technological competence: its changing impact on corporate diversification and internationalization. *Industrial and Corporate Change* **9**: 21–51.

Capron L, Mitchell W, Swaminathan A. 2001. Asset divestiture following horizontal acquisitions: a dynamic view. *Strategic Management Journal* **22**(9): 817–844.

Chang SJ. 1996. An evolutionary perspective on diversification and corporate restructuring: entry, exit, and economic performance during 1981–1989. *Strategic Management Journal* **17**(8): 587–611.

Chang SJ, Hong J. 2000. Economic performance of group-affiliated companies in Korea: intragroup resource sharing and internal business transactions. *Academy of Management Journal* **43**(3): 429–448.

Duhaime IM, Grant JH. 1984. Factors influencing divestment decision-making: evidence from a field study. *Strategic Management Journal* **5**(4): 301–318.

Duncan R, Weiss A. 1979. Organizational learning: implications for organization design. *Research in Organizational Behavior* **1**: 75–123.

Farjoun M. 1990. Beyond industry boundaries: human expertise, diversification, and related industry group. Unpublished PhD diss., Northwestern University: Evanston, IL.

Farjoun M. 1998. The independent and joint effects of the skill and physical bases of relatedness in diversification. *Strategic Management Journal* **19**(8): 611–630.

de Figueiredo JM, Kyle MK. 2006. Surviving the gales of creative destruction: the determinants of product turnover. *Strategic Management Journal* **27**(3): 241–264.

de Figueiredo J, Silverman B. 2007. Churn, baby, churn: strategic dynamics among dominant and fringe firms in a segmented industry. *Management Science* **53**(4): 632–650.

Foss NJ, Klein PG, Kor YY, Mahoney JT. 2008. Entrepreneurship, subjectivism, and the resource-based view: toward a new synthesis. *Strategic Entrepreneurship Journal* **2**: 73–94.

Garcia-Vega M. 2006. Does technological diversification promote innovation? An empirical analysis for European firms. *Research Policy* **35**: 230–246.

Gort M. 1962. *Diversification and Integration in American Industry*. Princeton University Press: Princeton, NJ.

Gort M, Klepper S. 1982. Time paths in the diffusion of product innovations. *Economic Journal* **92**(367): 630–653.

Grant RM. 1996. Toward a knowledge-based theory of the firm. *Strategic Management Journal* **17**: 109–122.

Hall BH, Jaffe A, Trajtenberg M. 2001. The NBER patent citations data file: lessons, insights, and methodological tools. NBER working paper 8498, Cambridge, MA.

Harrigan KR. 1980. Strategy formulation in declining industries. *Academy of Management Review* **5**(4): 599–604.

Helfat CE, Eisenhardt KM. 2004. Inter-temporal economies of scope, organizational modularity, and the dynamics of diversification. *Strategic Management Journal* **25**(13): 1217–1232.

Hill CWL, Hansen GS. 1991. A longitudinal study of the cause and consequences of changes in diversification in the US pharmaceutical industry 1977–1986. *Strategic Management Journal* **12**(3): 187–199.

Hitt MA, Hoskisson RE, Kim H. 1997. International diversification: effects on innovation and firm performance in product-diversified firms. *Academy of Management Journal* **40**(4): 767–798.

Hoskisson RO, Johnson RA. 1992. Research notes and communications corporate restructuring and strategic change: the effect on diversification strategy and R&D intensity. *Strategic Management Journal* **13**(8): 625–634.

Jovanovic B. 1982. Selection and the evolution of industry. *Econometrica* **50**(3): 649–670.

Jovanovic B. 1993. The diversification of production. *Brookings Papers on Economic Activity* **1993**: 197–247.

Klepper S. 1996. Entry, exit, growth, and innovation over the product life cycle. *American Economic Review* **86**(3): 562–583.

Klepper S, Graddy E. 1990. The evolution of new industries and the determinants of market structure. *RAND Journal of Economics* **21**(1): 27–44.

Kogut B, Zander U. 1992. Knowledge of the firm, combinative capabilities, and the replication of technology. *Organization Science* **3**(3): 383–397.

Lang HP, Stulz R. 1994. Tobin's q, corporate diversification, and firm performance. *Journal of Political Economy* **102**: 1248–1280.

Lavin MR. 1992. *Business Information: How to Find It, How to Use It* (2nd edn). Oryx Press: Phoenix, AZ.

Lee GK. 2008. Relevance of organizational capabilities and its dynamics: what to learn from entrants' product portfolios about the determinants of entry timing. *Strategic Management Journal* **29**(12): 1257–1280.

Lee GK, Lieberman MB. 2010. Acquisition vs. internal development as modes of market entry. *Strategic Management Journal* **31**(2): 140–158.

Levinthal DA, March JG. 1981. A model of adaptive organizational search. *Journal of Economic Behavior & Organization* **2**(4): 307–333.

Levinthal DA, Wu B. 2010. Opportunity costs and non-scale free capabilities: profit maximization, corporate scope, and profit margins. *Strategic Management Journal* **31**(7): 780–801.

Mahoney JT, Pandian JR. 1992. The resource-based view within the conversation of strategic management. *Strategic Management Journal* **13**(5): 363–380.

Markides CC, Williamson PJ. 1994. Related diversification, core competences and corporate performance. *Strategic Management Journal* **15**(S2): 149–165.

Miller DJ. 2004. Firms' technological resources and the performance effects of diversification: a longitudinal study. *Strategic Management Journal* **25**(11): 1097–1119.

Miller DJ. 2006. Technological diversity, related diversification, and firm performance. *Strategic Management Journal* **27**: 601–619.

Miller DJ, Fern MJ, Cardinal LB. 2007. The use of knowledge for technological innovation within the diversified firm. *Academy of Management Journal* **50**(2): 308–326.

Mitchell W. 1991. Dual clocks: entry order influences on incumbent and newcomer market share and survival when specialized assets retain their value. *Strategic Management Journal* **12**: 85–100.

Montgomery CA, Thomas AR, Kamath R. 1984. Divestiture, market valuation, and strategy. *Academy of Management Journal* **27**(4): 830–840.

Moreno-Badia M, Miranda V, Van Beveren I. 2008. Globalization drives strategic product switching. SSRN eLibrary.

Nelson RR, Winter SG. 1982. *An Evolutionary Theory of Economic Change*. Harvard University Press: Cambridge, MA.

Palepu K. 1985. Diversification strategy, profit performance and the entropy measure. *Strategic Management Journal* **6**(3): 239–255.

Palich LE, Cardinal LB, Miller CC. 2000. Curvilinearity in the diversification–performance linkage: an examination over three decades of research. *Strategic Management Journal* **21**(2): 155–174.

Pennings JM, Barkema H, Douma S. 1994. Organizational learning and diversification. *Academy of Management Journal* **37**(3): 608–640.

Penrose ET. 1959. *The Theory of the Growth of the Firm*. John Wiley: New York, NY.

Priem RL, Li S, Carr JC. 2012. Insights and new directions from demand-side approaches to technology innovation, entrepreneurship, and strategic management research. *Journal of Management* **38**(1): 346–374.

Puranam P, Srikanth K. 2007. What they know vs. what they do: how acquirers leverage technology acquisitions. *Strategic Management Journal* **28**: 805–825.

Robins JA, Wiersema M. 1995. A resource-based approach to the multibusiness firm. *Strategic Management Journal* **16**: 277–299.

Rumelt RP. 1974. *Strategy, Structure, and Economic Performance*. Harvard Business School Press: Cambridge, MA.

Sakhartov AV, Folta TB. 2014. Resource relatedness, redeployability, and firm value. *Strategic Management Journal* **35**: 1781–1797.

Sakhartov AV, Folta TB. 2015. Getting beyond relatedness as a driver of corporate value. *Strategic Management Journal* **36**(13): 1939–1959.

Silverman BS. 1999. Technological resources and the direction of corporate diversification: toward an integration of the resource-based view and transaction cost economics. *Management Science* **45**(8): 1109–1124.

Teece DJ. 1980. Economies of scope and the scope of the enterprise. *Journal of Economic Behavior and Organization* **1**(3): 223–247.

Teece DJ. 1982. Towards an economic theory of the multiproduct firm. *Journal of Economic Behavior and Organization* **3**(1): 39–63.

Villalonga B. 2004. Diversification discount or premium? New evidence from the business information tracking series. *Journal of Finance* **59**: 479–506.

Villalonga B, McGahan AM. 2005. The choice among acquisitions, alliances, and divestitures. *Strategic Management Journal* **26**: 1183–1208.

Wernerfelt B. 1984. A resource-based view of the firm. *Strategic Management Journal* **5**(2): 171–180.

Wu B. 2013. Opportunity costs, industry dynamics, and corporate diversification: evidence from the cardiovascular medical device industry, 1976–2004. *Strategic Management Journal* **34**: 1265–1287.

Wu B, Knott AM. 2006. Entrepreneurial risk and market entry. *Management Science* **52**(9): 1315–1330.

DOI: 10.1002/smj