Incumbent Entry into New Market Niches: The Role of Experience and Managerial Choice in the Creation of Dynamic Capabilities

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Increasingly, technological innovation creates markets for new products and services. To survive, firms must respond to these new markets. How do firms develop the capabilities necessary to succeed in such changing conditions? Some suggest that experience with previous entry builds such capabilities. Others suggest that capabilities arise from experience producing and selling to existing markets. The role of managers is also debated. Some argue that experience with existing markets causes managers to miss entry opportunities. Others argue that managers enter new markets when their firm possesses the experience needed to compete effectively.

In this paper, we explore these issues by investigating entry patterns in the disk-drive industry. We investigate the effect of experience in existing markets and experience with previous market entry. We find that experience in previous markets increased the probability that a firm would enter a new market. We show that this experience had greater value if the firm entered the new market. We infer that managers chose to enter these markets to obtain this increase in value.

(*Disk Drives; Dynamic Capabilities; Niche Innovation; Market Entry; Organizational Inertia; Experience*)

1. Introduction

Scholars have long proposed that technological change can cause market waves that incumbent firms must master if they are to survive. How firms develop the capabilities needed to surmount these waves remains an issue of debate. Experience is thought to be critical, but the type of experience required and the role of managers in exploiting or squandering this experience is imperfectly understood. In this article, we further investigate the effect of different types of experience on market entry, and we explore the role managers play in moderating the effect of such experience.

The ability to respond to a new market is part of a class of organizational abilities called "dynamic capabilities." Eisenhardt and Martin (2000, p. 1107) define dynamic capabilities as "organizational and strategic routines by which firms achieve new resource configurations as markets emerge." These capabilities both constrain and enable a firm's ability to change because they must be built through experience rather than acquired through market transactions (Teece et al. 1997, p. 528). Generating such capabilities requires enough experience that "tacit production and organizational knowledge" (Foss and Langlois 1997, p. 18) becomes stored "in new patterns of activity, in

'routines'" (Teece et al. 1997, p. 520). These routines help the firm integrate (e.g., Helfat and Raubitschek 2000), reconfigure (e.g., Hargadon and Sutton 1997), or develop and release new resources (e.g., Henderson and Cockburn 1994, Sull 1999).

The idea that routines might lead to dynamic capabilities seems to contradict well-known theories that routines cause organizational inertia (Hannan and Freeman 1984). However, such inference ignores the potential for routines to exist at a higher "order"[1] and thereby preserve ongoing change processes (Nelson and Winter 1982, Winter 2000). Just as experience with operating routines preserves and entrenches those routines, experience changing operating routines necessitates "modification routines … to make further, similar changes" (Amburgey et al. 1993, p. 54). Thus, theory suggests that experience of one "order" creates routines that reduce a firm's dynamic capability, while that of another generates routines that increase it. For example, with respect to market positioning, the more a firm gains experience producing and selling products to its existing customers, the less likely it would be to enter new markets. However, the more a firm gains experience reorganizing or redirecting its effort to new markets, the more likely it would be to continue to do so. To differentiate these two types of experience, we term the first *static experience* and the second *transformational experience*. *Static experience* is gained from further elaboration of existing structures, positions, and strategies. *Transformational experience* is gained from changing these attributes.

How managers might exacerbate, mitigate, or moderate the effect of experience remains an important theoretical and empirical issue for the emerging literature on dynamic capabilities (Eisenhart and Martin 2000, Rosenbloom 2000, Tripsas and Gavetti 2000). One possibility is that managers play a minor role, and thus dynamic capabilities and dynamic tendencies are synonymous. A second possibility is that managerial routines and rigidities are the critical

[1] We follow Lewin's (1951) use of "order." For example, the measurement of a variable's level at any point in time is order zero, change in that level is Order 1, change in the rate of change is Order 2, and so forth.

determinant of a firm's dynamic capabilities. A third possibility is managers make the best use of their firm's capabilities, and initiate action when existing capabilities provide an advantage in a new context.

All three possibilities have been explored in the literature on organizational response to "niche innovations" (Abernathy and Clark 1985, Starbuck and Hedberg 1977, Utterback and Kim 1986, Mitchell 1989). As originally defined by Abernathy and Clark (1985), a niche innovation occurs when new technology creates a new market opportunity but this new technology does not obsolete the capabilities of incumbent firms. As a result, incumbent firms can and should enter and thrive in such new market niches. The issue remains in dispute, however, since scholars disagree about how often managerial rigidities cause firms to squander these capabilities (Christensen 1997, Mitchell 1989, Lambkin 1988).

In this article, we contribute to the literature on dynamic capabilities by testing which model of dynamic capabilities best matches entry patterns in the disk drive industry. We first hypothesize that static and transformational experience directly influences market entry (§§2.1 and 2.2). We then review literature that experience creates managerial rigidities (§2.3). As a result, firms have the ability to succeed in new markets but fail to enter. Finally (§2.4), we hypothesize that managers take dynamic actions (enter new markets) when their firm has the necessary dynamic capabilities. We then test these models by exploring how experience influenced both the value and probability of market entry.

2. Literature Review

2.1. Static Experience and Dynamic Capability
Theories that predict that incumbent firms will fail to enter new market niches assume that experience leads to routinization and inertia. According to these theories, experience leads to habitual routines that reinforce existing practices and impede adaptation (Gersick 1989, Hackman 1990). These routines may take form in organizational structures that further impede change (Hlavacek and Thompson 1973). As a result, the inertia of current practice can overwhelm

concerted efforts to change (Hannan and Freeman 1984).

Experience with operating routines for one market can impede a firm's ability to enter a new market niche. Nelson and Winter (1982) argue that experience with particular operating routines restricts an organization's ability to produce other products or to acquire new resources. Teece et al. (1997, p. 520) argue that incumbents often fail to enter new market niches because of a "mismatch ... between the set of organizational processes needed to support the conventional product/service and the requirements of the new." Miller and Chen (1994, p. 2) argue that inertia in the form of "market-oriented activity can have an important impact on performance" by "severely retard[ing] adaptation." Greve (1996) argues that experience in one industry market niche can lead to investments and psychological commitments to a set way of doing things that then impedes entry into another market niche. Thus, our first hypothesis is as follows.

HYPOTHESIS 1. *The more experience a firm has serving existing industry markets, the less likely it is that the firm will enter a new market niche in that industry.*

2.2. Transformational Experience and Dynamic Capability

Transformational experience can influence dynamic capabilities either by reducing the buildup of organizational inertia or by creating routines that support organizational change. At the micro level, Katz and Allen (1982), have found that periodic reorganization of product development teams prevents them from developing a "not-invented-here" syndrome. At the firm level, Tushman and Romanelli (1985) argue that reorganization reduces inertia and thereby keeps the organization adaptable. Amburgey et al. (1993) argue that organizational change can "reset" the organization's inertial clock. As a result, transformational experience is likely to increase the probability of a subsequent change.

HYPOTHESIS 2A. *The probability that an organization will enter a new market niche will decrease with the amount of time elapsed since it last underwent a major organizational change.*

Transformational experience might also provide a dynamic capability by creating routines that support organizational change (Amburgey et al. 1993). Schumpeter (1950) proposed that institutionalizing the innovation process creates new business opportunities; however, few previous studies of response to new market niches have considered the potential for entry "momentum." In part, this is a result of emphasis in previous empirical work on market niches that appeared infrequently and were separated by years of relative stasis. As a result, there was little potential for organizations to build up market entry routines or momentum.

Experience with market entry can reduce the cost of identifying future profit opportunities by reducing search costs. As firms gain experience, they create routines for instrumenting and analyzing the world (Nelson and Winter 1982). Firms may also learn from previous transitions about their own misperceptions of new markets and so update their expectations about future ones. Alternatively, they may learn tactics that reduce the cost of future market entry. This learning may also occur through natural selection. Prior niche transitions may weed out firms with poor information channels or other impediments to effective adaptation. As Teece et al. (1997, p. 521) note: "The capacity to reconfigure and transform is itself a learned organizational skill. The more frequently practiced, the easier accomplished." Thus transformational experience has the potential to lead to market entry "momentum."

HYPOTHESIS 2B. *Experienced firms entering a previous market niche will be more likely to enter a new market niche.*

2.3. Static Experience and Dynamic Capabilities: The Role of Managerial Rigidities

In the above discussion we did not distinguish the organization's ability to enter a new market niche from the managerial choice to do so. In essence, we were agnostic about whether experience leads to inertia in the organization or in its management. Nor did we consider how the firm might have fared if it had (or had not) entered. Answering this question is important to both theory and practice.

If incumbent firms have the capacity to succeed in new markets but their managers often fail to initiate entry, it would suggest that systematic managerial rigidities limit firm dynamic capabilities. Indeed, based on their observation of managerial decisions and processes, several scholars make precisely this argument. Starbuck (1988) concludes that routines and systems within an existing mechanical calculator organization kept managers from perceiving the potential size of new market niches and so prevented the firm from capitalizing on its advantageous position. Utterback and Kim (1986) and Christensen (1997) argue that management experience with existing customers and products caused mental imprinting that prevented effective understanding of new markets. They argue that, as a result, managers often squander their firm's technological advantages. Producers of high-fidelity stereo equipment, for example, reportedly missed the portable radio market because they discounted the size of a market whose customers valued portability over high fidelity (Christensen 1997). Scholars also argue that misaligned incentives may inhibit managerial action (Christensen and Bower 1996). Experience with existing markets can exacerbate this incentive problem by creating systems that reward sales to existing customers rather than to new ones.

In Hypothesis 1, we were noncommittal about whether experience (1) causes inertia that constrains an organization's ability to change or (2) reduces the probability its managers will initiate change. Now we clarify this ambiguity by explicitly hypothesizing that incumbent firms have the capacity to succeed in new market niches. Because it is a necessary part of the theory we wish to test, we also repeat Hypothesis 1 (as Hypothesis 3B) that experience reduces the probability that a firm will enter a new market niche. Only if both parts of our hypothesis are true will we support theories that managerial rigidities systematically restrict entry into new market niches.

HYPOTHESIS 3A. *Firms with experience in existing markets can increase sales if they enter new market niches.*

HYPOTHESIS 3B. *The more a firm has experience serving existing markets in an industry, the less likely it is that the firm will enter a new market niche in that industry.*

2.4. Static Experience and Dynamic Capabilities: The Role of Managerial Choice

A second perspective expects managers to enter new market niches if their firm has the capability to compete effectively (Lambkin 1988, Klepper and Simons 2000). If so, managerial decisions may dramatically alter the effect of static experience on market entry. At least since Penrose (1959), scholars have argued that static experience can provide capabilities needed to compete successfully in a new market niche. For example, Helfat (1997) demonstrates that static experience in the oil industry facilitated entry into the natural gas market via capability in coal gasification technology. Research has also shown that production and sales experience in one market can reduce the marginal cost of production, logistics, and sales in related markets (Argote and Epple 1990, Argote et al. 1990). If managers perceive these experience-based capabilities, they should be more likely to enter new market niches.

The nature of the capabilities generated by static experience may amplify their effect on market entry. The capabilities generated through static experience are often hard to use in other industries and hard to copy by competing firms in the same industry (Argote et al. 1990). In essence, experience in existing market niches provides an industry-specific asset whose value can best be exploited by entry into a related market niche (Teece 1986, Tripsas 1997, Mitchell 1989). If managers perceive these capabilities, firms with more static experience should be more likely to enter new market niches.

Thus, we again form a two-part hypothesis. First, we hypothesize that static experience increases the value of entry into new markets. Then, we hypothesize that firms are *more* likely to enter if they have such experience. If both are supported, we can infer that managers direct entry into new markets to exploit the value of this experience. Note further that Hypothesis 4B and Hypothesis 1/Hypothesis 3B offer completely contrary predictions. This is discussed further below.

HYPOTHESIS 4A. *The more experience a firm has serving existing markets in an industry, the more it can increase its sales by entering a new market niche.*

HYPOTHESIS 4B. *The more a firm has experience serving existing markets in an industry, the more likely it will enter a new market niche in that industry.*

3. Research Method

The disk drive industry provides an excellent setting to explore the relationship among dynamic capabilities, experience, and entry into new technology-created market niches. From 1976 to 1995, the industry went through several market changes. The original 14″ hard drives were largely used in mainframe computers. The emergence of mini-computers inaugurated the 8″ market; 5.25″ drives became popular for use in desktop machines. Finally, 3.5″ and smaller drives found use in desktop and portable systems.

In our analysis, we chose to emphasize quantitative analysis rather than case analysis. This choice has both advantages and disadvantages (Chesbrough 1999c). On one hand, we avoid selection bias because we analyze a sample that is very close to the full population of firms. On the other hand, we cannot exploit rich sources of data about each firm. For example, we can observe what firms do, but not what managers think and perceive. To partially correct for the potential limitations of our methods, we conducted a careful archival search of news reports on each company. We also interviewed industry executives and experts.

3.1. Sample

To test our hypotheses, we collected data for all firms producing a rigid hard drive for the time period 1976 to 1995. We collected much of our data from *Disk/Trend Report*, a highly reliable and complete source of industry data (Christensen et al. 1998, Lerner 1997, Christensen and Bower 1996). The population consisted of 208 business units representing 174 distinct organizations.

From this panel data, we constructed a list of all organizations that ever produced a disk drive, and we created a variable that indicated whether each organization produced a drive in each disk drive size (also called a *form factor* or *category*: 14″, 10″, 9″, 8″, 5.25″, 3.5″). To determine the history of each organization and to determine major reorganizations, we searched the Lexis-Nexis files for reports of reorganization, mergers, changes in ownership, and name

changes. From the *Disk/Trend Report*, we collected unit sales for each disk drive category, total disk sales for each organization, and total corporate sales for each organization.[2] We linked the *Disk/Trend* data to the Dun and Bradstreet and Compustat databases to confirm the sales data of public companies and to confirm (1) the nation of ownership for each company and (2) whether the disk drive company was part of a larger electronics company that used disk drives (i.e., a "captive" producer).

We chose to evaluate entry into the four main drive sizes (14″, 8″, 5.25″, and 3.5″). Smaller drives had only recently arrived on the market by the end of our sample, so for this round of analysis, we excluded them. We also combined the 9″ with the 8″, giving them the same treatment as *Disk/Trend Report*. We included the 10″ producers with the 14″ producers. Only three firms ever made a 10″ drive (and none ever produced more than 1,000 drives in one year), and only eight made a 9″ drive. The results presented do not change when the 9″ or 10″ drives are excluded from the sample. With the remaining drive sizes, we have no left censoring for entry (the first 8″ drive was not commercialized until 1978 and the others not until after that). We do have, however, right censoring because our sample stops in 1995 and some producers continued to manufacture 8″, 5.25″, and 3.5″ drives after that. We also deliberately stop our entry analysis by the peak sales year of the market niche (1987 for the 8″ and 1988 for the 5.25″ drives). We did this to prevent firms pursuing an "end-of-life" strategy (i.e., buying up production of very old drives and selling them off without intention of further efforts) from confounding our interpretation. The statistical significance of our findings does not change if we include these later years; in fact, the results are slightly stronger than the conservative results reported here.

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[2] *Disk/Trend Report* only reports sales above a certain de minimus level (which changed from year to year but averaged about 200 units). Thus, we used the de minimus level of shipments for each company whose sales were not reported in each year. In 12 cases (out of 3,497 or 0.3%), missing data were interpolated, as per the following example: 1985 sales of 164,000 units; 1986, de minimus; 1987, 184,000 units. After using Lexis/Nexis, company reports, Compustat, and *Disk/Trend Reports* to verify that the company did not temporarily exit the market, we assigned 174,000 units to 1986.

3.1.1. Methods. We apply two statistical methods to our analyze our data. We use a random-effects logistic regression to analyze entry patterns. Then we use a method developed by Heckman (1979) to evaluate how entry affected the future sales of the company.

3.1.2. Entry. Martin and Mitchell (1998) cite four main benefits from the discrete-time logistic method, three of which are salient to our study. The first is the ability to handle right-censored data. The second benefit is the ability to handle "ties," multiple events that occur in the unavoidably large periods of one year. They also note the third benefit, that discrete-time logit analysis allows time-varying independent variables. All of these are important to our investigation. The final benefit, the ability to handle repeated events, is not a factor in this study. Once a firm has entered a new niche, we remove it from further consideration.

For presentation purposes, we combine our three transitions together (see §3.2.2). To correct for a lack of independence across observations of the same firm, we use a random-effects specification. We use a random- rather than a fixed-effects specification to allow us to include constant variables (such as *Japan* or *Captive*) and to include firms that never entered during the entire panel.

The model is specified as:

$$P_{i,\,t+1} = F(Z_{it}) = F(a_i + \boldsymbol{\beta}'\mathbf{X}_{it}) = e^{(Z_{it})}/(1 + e^{(Z_{it})})$$

where P is the probability that firm i will produce a drive in that category in the next year ($t+1$). For example, when examining the 8″ drive category, it is the probability that firm i will produce an 8″ drive in the next year. The vector $\mathbf{X}_{it}$ represents the characteristics of the ith firm or its industry in year t. The firm individual or random effects are measured as a_i. A firm is "at risk" to enter as long as the new niche exists, industry-wide sales in the category have not peaked (see above), the firm is still alive, and the firm has not yet entered.

Discrete-time models like the one described above have become popular for data that are reported for discrete time periods (e.g., every year). However, since economic decisions probably occur in continuous time, a hazard rate specification could also

be appropriate. Because our explanatory variables vary over time, our choice of hazard rate models is restricted to one using a partial likelihood estimation procedure. To ensure that our discrete-time model produced robust results, we repeated our analysis using a Cox proportional hazard regression and confirmed our findings.

3.1.3. Effect of Entry on Sales. To measure the effect of experience on sales, we use a method pioneered by Heckman (1979). We use a maximum-likelihood simultaneous estimation of the entry choice (the effect of the independent variables on entry, usually called the *choice model*) and the effect of the independent variables on future sales correcting for the entry choice (called the *performance model*). The method has a property that allows us to estimate the counterfactual case. We can, for example, estimate (based on firm characteristics of entrants and nonentrants) how a firm that *did* enter would have performed if it *had not* entered a market niche.

This particular method can only be used for cross-sectional data, so we must select a year for our analysis. We chose to use the first year of each market niche. We then use the attributes of each incumbent firm that produced in that year to predict entry into the new market niche and future sales performance. For example, we consider all of the disk drive producers in 1978 that made a 14″ or 10″ drive. We use their characteristics in 1978 to predict their entry into the 8″ market and to predict their future sales of 14″, 10″, and 8″ drives. Again, for presentation purposes, we combine our three transitions together (see §3.2.2).

3.2. Variables

3.2.1. Independent Variables. Our hypotheses propose that two types of experience influence both entry and success. The first is the firm's experience producing and selling to existing markets—what we call its "static" experience. The second is the firm's experience with major change, or what we call its "transformational" experience.

With respect to static experience, numerous studies have found that a log relationship exists between experience in production and sales and unit costs of production (Argote and Epple 1990). Research

also suggests that this experience decays with time (Argote et al. 1990, Baum and Ingram 1998). Following previous research, we estimate *production and sales experience* as the log of the number of units sold in all previous market niches in that year.[3] We used Baum and Ingram's (1998) method to discount experience over time. We performed a sensitivity analysis of our results by using different methods for constructing an experience variable. We constructed experience using different discount rates. We found very similar results.

$$\text{Experience}_i$$
$$= \sum_{j=i,y} \frac{\ln(\text{unitsales}_j + 1)}{(i - j + 1)},$$

where
$$\begin{cases} j = \text{index year} \\ \text{unitsales} = \text{total production of drives} \\ \qquad\qquad \text{for the firm in year } i \\ i = \text{year in which experience} \\ \qquad \text{is measured} \\ y = \text{year of first sales for} \\ \qquad \text{the firm.} \end{cases}$$

Because experience tends to increase over time for all firms and this can be confounded with calendar time, we then created a normalized deviation of experience by year. Thus, when our *production and sales experience* variable has a value of 1.0, the firm in question had 1 standard deviation more experience than the average firm in that particular year. To separate the effect of production and sales experience from the passage of time, we also include a measure of the time a firm has been in the disk drive industry. *Cumulative industry experience* is the cumulative number of years that the firm has produced in any market niches up to that year.

With respect to transformational experience, theory suggests that firms that have experience redirecting their energies may develop the skills and routines that

encourage them to do it again. To capture this effect, we construct a variable (*prior transition experience*) that measures whether the firm had previously entered a new market niche. For example, if a firm originally produced a 14″ drive but had entered the 8″ drive market, they then had experience with market entry and this might affect their entry into the 5.25″ drive market. The variable is scored as a dummy variable with 1 indicating that the firm had (prior to that year) entered a market niche other than its original niche.

Scholars argue that transformational events can reset an organization's inertia and thereby encourage change (e.g., reorganizes or changes its direction). We follow Amburgey et al. (1993) in creating *change clock* as the log of elapsed time since the firm last entered any market niche or since a disk-drive-related merger or acquisition occurred for that firm. We also separated these two events into different clocks, repeated our analysis, and found similar results.

3.2.2. Position Variables and Controls. The firm's dynamic capabilities might be affected by what Teece et al. (1997) call the "position" of the firm. This position includes its product and market position, structure, size, and institutional setting. For example, companies that pursue a "high-end" strategy of providing high capacity drives may miss opportunities to sell "low-end" drives to new markets (Christensen 1997). To capture the firm's technological position, we create a variable (*drive density*) that measures the relative data density of the firm's densest drive. The variable is calculated as the normalized deviation of the firm's densest drive relative to the densest drives produced by other firms in that year. To further measure the firm's market position, we create a dummy variable (*producing in prior*) that indicates (1 if true, 0 if false) if the firm is producing in the immediately preceding market niche (e.g., both the 14″ and 8″ markets preceded the 5.25″ market, but the 8″ market was immediately preceding).

A firm's market share may affect its competitive position and might also provide an asset in entering a new market (Mitchell 1989). We measure each firm's *market share* as the number of drives it sold in a given year divided by the total number of drives

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[3] For example, the 14″ and 8″ markets are previous to the 5.25″ market. We removed five firms (four in the 8″ transition and one in the 5.25″) from our sample firms that "backed into" a previous market. For example, they entered the 8″ market after entering the 5.25″ market. The results reported below are more conservative than those with the "back-in" firms.

sold in the market that year.[4] The firm's structure might also influence its behavior. For example, integrated firms might have lower market risk and thus would be more prone to enter. To account for this effect, we create a dummy variable (*captive*) indicating whether the firm uses disk drives in its own products. To control for the effect of the resources that might be provided by a diversified firm, we created a variable *corporate sales*. This measures the log of total U.S. dollar revenues for the entire corporation lagged by one year. Finally, scholars argue that institutional conditions in Japan influence entry patterns (Chesbrough 1999a, 1999b). To control for this, we constructed a dummy variable for whether the disk-drive organization was owned by a Japanese company (*Japan*) or by a company outside of the U.S. and Japan (*ROW* for "rest of world").

Broader industry conditions might also affect entry. The first is the number of firms at risk to enter. Our variable *firms at risk to enter* is the number of disk drive firms that have not yet entered the new niche. The market density of the niche market might also signal the value of the new niche and thus encourage entry (conversely, it might discourage it if firms seek unique entry opportunities). To account for this effect, we created a measure of the number of firms in the new niche (*competitors*). We also added a square of *competitors* variable with similar results.[5]

To simplify our analysis and presentation, we combine all three transitions together in our analysis. To capture transition-specific differences we created a dummy variable for each transition. For example, when considering the transition from 14" to 8", we coded every firm at risk in that sample with *transition into 8 = 1*; for those not at risk, *transition into 8 = 0*. Some firms may appear in multiple transitions. We assume that observations across firms are independent, but that observations from the same firm are not independent. We therefore report robust standard

errors that correct for this possible lack of within-group independence. A summary of the variables and their descriptive statistics are shown in Table 1.

4. Results

First we explore the effect of experience on entry into new market niches. In Model 1 of Table 2, we present a specification of our model that includes three measures of experience (*production and sales experience, prior transition experience*, and *cumulative industry experience*), several measures of industry position, and control variables. We find strong evidence that static experience (*production and sales experience*) predicts entry. Interestingly, we find weak evidence that transformational experience (*prior transition experience*) actually has the opposite effect to the one predicted. Of course this does not suggest that firms who had been through a prior transition were less likely to enter; such firms were likely to have both more production and sales experience, higher market share, and to be producing in a prior niche. However, it suggests that in and of itself prior transition experience did not encourage entry. We believe the variable is picking up the effect of weak firms that staggered into the prior transition and then did not have sufficient resources to quickly respond to yet another niche.

In Table 2, Model 2, we present a slight modification of Model 1. To capture the potential for reorganizations to reset the organization's inertia clock, we replace *cumulative industry experience* with *change clock*. This formulation allows us to directly test Hypothesis 2A. We do not find support for the hypothesis that the probability that an organization will enter a new market niche will decrease with the time since it last underwent a major organizational change. Indeed, we find marginally statistically significant evidence of the opposite effect. We believe this suggests that establishing a market presence after market entry requires investment in capital and managerial attention that temporarily precludes further entry. Although we have not reported it here, we also added a square term of *change clock* to investigate whether the probability of entry at first decreases and then increases with the time since the last organization. The coefficient for the squared term had a negative sign but was not statistically significant.

[4] Since this variable includes a few outliers, we also created a dummy variable indicating if the firm had more than 2% of the market. We obtained similar results.

[5] Note that these three variables could be endogenously determined. The results do not change when excluded.

Table 1   Descriptive Statistics and Correlations

Variable	Description	Mean/s.d.	1	2	3	4	5	6	7	8	9	10	11	12	13
							Predicting Entry ($N = 988$)								
1. Production & sales experience	Deviation of discounted experience for each firm for each year	−0.17/0.89	1.00												
2. Prior transition experience	dummy = 1 if previously entered niche other than original niche	0.27/0.45	0.28	1.00											
3. Cumulative industry experience	Log no. of years company has been producing disk drives	1.60/0.61	0.21	0.28	1.00										
4. Change clock	the log of years since last entry into any category or since merger	1.22/0.63	0.64	0.16	0.07	1.00									
5. Drive density	Deviation of maximum disk drive density for each firm for each year	−0.20/0.92	−0.05	0.25	0.29	−0.07	1.00								
6. Market share	market share in the prior year (%)	0.01/0.04	0.08	0.65	0.16	0.02	0.18	1.00							
7. Captive	dummy = 1 if parent buys output	0.46/0.50	0.13	0.10	0.22	0.14	0.06	0.11	1.00						
8. Corporate sales	Log of total firm sales lagged 1 yr.	15.3/6.00	0.59	0.37	0.33	0.47	0.11	0.22	0.30	1.00					
9. Japan	dummy = 1 if Japanese	0.12/0.32	0.01	−0.06	0.09	−0.09	0.15	−0.07	0.18	0.03	1.00				
10. ROW	dummy = 1 non-Japanese, non-U.S.	0.20/0.40	−0.00	−0.14	−0.17	−0.04	−0.17	−0.10	0.16	−0.06	−0.18	1.00			
11. Producing in prior	dummy = 1 if producing in the previous niche, 0 otherwise.	0.63/0.48	−0.01	0.14	0.10	−0.16	0.19	0.08	−0.04	0.01	0.22	0.01	1.00		
12. Firms at risk to enter	The number of firms that are alive that have not yet entered next niche	42.0/20.0	−0.21	0.18	0.11	−0.25	0.14	0.09	0.02	−0.03	0.18	−0.13	−0.06	1.00	
13. Competitors	The number of competitors currently in the next niche	76.1/29.1	0.21	−0.06	0.18	0.15	−0.09	−0.09	−0.09	−0.00	−0.04	0.04	−0.11	−0.01	1.00
							Predicting future sales ($N = 174$)								
1. Production & sales experience	Deviation of discounted experience for each firm for each year	0/1.00	1.00												
2. Prior transition experience	dummy = 1 if previously entered niche other than original niche	0.28/0.45	0.32	1.00											
3. Cumulative experience	Log no. of years company has been producing disk drives	4.36/3.91	0.25	0.73	1.00										
4. Change clock	the log of year since last entry into any category or since merger	1.06/0.55	0.37	0.20	0.05	1.00									
5. Drive density	Deviation of maximum disk drive density for each firm for each year	−0.03/0.99	0.16	0.26	0.24	−0.07	1.00								
6. Market share	market share in the prior year (%)	0.02/0.05	0.11	0.72	0.16	0.08	0.23	1.00							
7. Captive	dummy = 1 if parent buys output	0.48/0.50	0.28	0.13	0.19	0.29	0.12	0.18	1.00						
8. Corporate sales	Log of total firm sales lagged 1 yr.	15.9/5.77	0.39	0.39	0.34	0.64	0.15	0.27	0.44	1.00					
9. Japan	dummy = 1 if Japanese	0.17/0.38	0.05	−0.09	0.15	−0.06	0.27	−0.12	0.20	0.04	1.00				
10. ROW	dummy = 1 non-Japanese, non-U.S.	0.14/0.35	−0.07	−0.11	−0.10	−0.01	−0.12	−0.09	0.08	−0.01	−0.18	1.00			
11. Producing in prior	dummy = 1 if producing in the previous niche, 0 otherwise.	0.68/0.47	−0.33	0.19	0.10	−0.18	0.17	0.10	−0.02	0.07	0.31	−0.08	1.00		

Table 2 Predicting Whether a Company Entered the Next Market Niche

	logistic regression, random-effects	
	1.entry	2.entry
Production and sales experience	0.619*** (0.240)	0.625** (0.246)
Prior transition experience	−1.04* (0.600)	−0.876 (0.541)
Cumulative industry experience	0.683 (0.057)	
Change clock		0.670* (0.374)
Drive density	0.091 (0.165)	0.115 (0.173)
Market share	−1.60 (3.63)	−1.36 (3.82)
Captive	−0.027 (0.404)	−0.008 (0.426)
Corporate sales	0.085* (0.048)	0.094* (0.048)
Japan	2.07*** (0.546)	2.20*** (0.578)
ROW	0.556 (0.496)	0.642 (0.534)
Producing in prior	0.832** (0.382)	0.819** (0.389)
Firms at risk to enter	−0.015 (0.012)	−0.016 (0.013)
Competitors	0.015** (0.007)	0.018*** (0.007)
Transition into 8	−0.018 (0.438)	−0.149 (0.444)
Transition into 3.5	−1.27*** (0.454)	−1.24*** (0.447)
Constant	−5.72*** (1.24)	−5.91*** (1.26)
Log-likelihood	−256.4	−255.7
Wald χ^2	40.95	41.49
Prob > χ^2	0.0000	0.0000
N (obs)	988	988

*$p < 0.10$, **$p < 0.05$, ***$p < 0.01$, two-tailed tests, std errors in parentheses.

The coefficients for our control variables generally match previous studies. Consistent with Chesbrough (1999b), we find that Japanese firms were more likely to enter new market niches—suggesting that different institutional conditions, different access to resources, or different managerial philosophies affect market entry (Chesbrough 1999b). Consistent with several previous studies, we find that the firms are more likely to enter when there are more competitors in the market. One explanation is that the greater participation provides information about the viability of the market niche (Hannan and Carroll 1992). We also find evidence that firms that had previously entered the preceding market niche were more likely to enter new market niches, suggesting that firms have difficulty leapfrogging market niches. Finally, we find evidence that firms were less likely to enter the 3.5″ market than the 8″ or 5.25″ market. Beyond the end of our panel, some additional incumbents may have entered the 3.5″ market, but this would explain the significance of the coefficient only if many firms were founded and entered shortly after 1995. Other explanations for the result include increased concentration in the downstream computer market and a movement toward long-term contracts and large-volume suppliers that barred some firms.

Different formulations are possible for several of our variables, and we used these alternative measures to perform a sensitivity analysis of our findings. We included alternative measures of the firm's technological position (by replacing *drive density* with a measure of the distance to the technical frontier, the degree of adoption of the dominant design (cf. Christensen et al. 1998), or the mix of high- and low-technology sales) and organizational structure (multidivision organization and disk drive spin-off). We also included a measure of the niche's competitive situation (the Herfindahl index of market concentration). To differentiate static experience from complementary assets, we included proxies for complementary assets such as estimated total manufacturing capacity and flexibility (number of simultaneous designs produced). Finally, we tested our analysis using just the U.S. firms in our sample. Analysis using these alternative variables, sample, and model did not change the significance of the results reported above.[6]

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[6] We also used a fixed-effects logistic regression to investigate our sample. This analysis requires the removal of all of the constant variables from the model (e.g., *Japan, ROW, captive*) and those firms that failed to ever enter. It does, however, allow us to better correct for unobserved firm level differences. In this specification, *production and sales experience* remains highly statistically significant.

In summary, we do not support the hypothesis that static experience reduces market entry (Hypothesis 1 and Hypothesis 3B) or the hypothesis that transformational experience will increase entry (Hypothesis 2A and Hypothesis 2B). In other words, we do not find any evidence that experience generates inertia that directly influences market entry. Our market entry analysis best supports the hypothesis that the more a firm has experience serving existing markets in an industry, the *more* likely it will enter a new market niche (Hypothesis 4B), but it does not yet explore the underlying logic of Hypothesis 4. To do this, we must show that firms with more experience achieved better performance if they used this experience in new market niches. Because we do not want to confuse the decision to enter a new market with the effect of entry on the firm, we must correct for this "choice process" before analyzing performance. To do this we use a method advanced by Heckman (1979). Using our previous panel findings, we specify a choice model predicting who will enter a new market niche. We again find that the *production and sales experience* and Japanese ownership predict entry, and that firms were less likely to enter the 3.5" drive market.[7] These results are reported in Table 3.

Turning first to our control variables, we see that the constants differ ($p < 0.01$) between the two equations, suggesting that companies generally improved their sales by entering the new market niche. We also find that those firms that entered the 3.5" market had higher average sales—not surprising since this was by far the largest market. Interestingly, we find evidence that the density of a firm's existing drives (*drive density*) increased sales in new market niches ($p < 0.01$). This is consistent with a model proposed by

Table 3 Predicting Future Sales if Firm Enters (or Does Not Enter) New Market Niche

|	Simultaneous maximum-likelihood selection model		
	Choice Model:[†] Entered (probit)	*Perf. Model:* Future sales entry	*Perf. Model:* Future sales no entry
Production and sales	0.323**	1.009***	1.744***
experience	(0.139)	(0.179)	(0.164)
Prior transition experience	−0.045	−0.093	0.139
	(0.304)	(0.809)	(0.357)
Change clock	−0.296	−0.929	−0.034
	(0.323)	(0.695)	(0.200)
Drive density	0.206	0.781***	0.082
	(0.127)	(0.219)	(0.136)
Captive	0.233	−0.116	−0.396
	(0.260)	(0.576)	(0.266)
Corporate sales	0.047	0.096	0.023
	(0.030)	(0.072)	(0.018)
Japan	1.234***	−0.275	−0.384
	(0.389)	(0.711)	(0.347)
ROW	0.465	−1.310	0.929**
	(0.306)	(0.894)	(0.415)
Producing in prior	0.265	0.272	0.122
	(0.284)	(0.691)	(0.241)
Transition into 8	−0.211	−0.839	−0.090
	(0.361)	(0.711)	(0.246)
Transition into 3.5	−0.921***	2.196***	0.231
	(0.228)	(0.555)	(0.174)
Constant	−0.487	2.930***	1.217***
	(0.399)	(1.096)	(0.266)
Rho		0.015	−0.207
Lambda		0.029	−0.176
Wald χ^2		172.5***	227.7***
Obs. (censored, uncensored)	174	87,87	87,87

*$p < 0.10$, **$p < 0.05$, ***$p < 0.01$, two-tailed tests, std errors (adjusted for clustering) in parentheses.

[†]The choice model is estimated simultaneously for each case but is reported here for the "entered" case. Full results available from the authors.

Klepper and Simons (2000) that previous design experience provides a competitive advantage in new market niches and also consistent with Iansiti (2000), who argues that design experimentation enables incumbents to remain competitive.

Turning now to our main independent variable, we see that *production and sales experience* has a positive influence on future sales, regardless of whether the firm enters a new market niche or not. At first glance, it appears that this effect is stronger if the firm did not enter a new market niche, but such an

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[7] In formulating our choice model, we tried to follow the specification presented in Table 2. However, we could not keep the models exactly parallel. First, we had to remove industry descriptive variables because these are redundant in a cross-sectional model. In addition, we found that market share and experience were highly correlated in this sample. This is because sales in the previous niche are still at an early stage so both variables measure the degree to which a firm has been an early market leader in the previous niche. Alternative formulations using either measure provide similar results. Using both reduces the explanatory power of *production and sales experience* in the choice model, but does not change its significance in the performance model.

Figure 1   **Effects of Production and Sales Experience on Future Sales Depending on Entry Choice: The Case of 5.25" Drives**
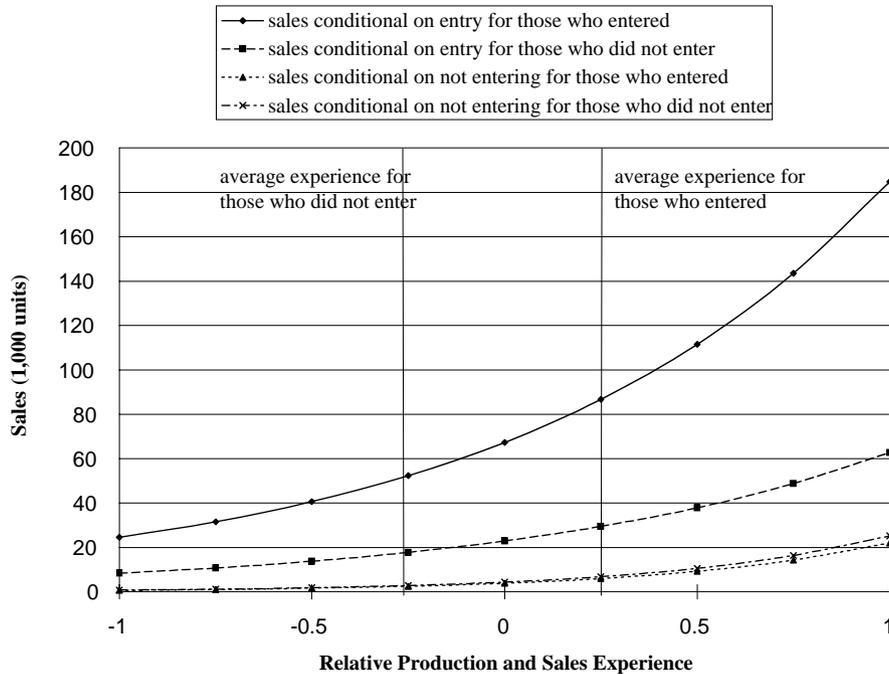
analysis overlooks the logarithmic form of the model. To understand the real effect on sales (as opposed to log sales), we must consider the value of the other variables. For example, the larger constant for the firms that entered new niches will cause an amplification of the effect of *production and sales experience*. Using the median value of all variables in the appropriate sample, we calculated the effect of previous production experience on future sales for those firms that entered a new market niche and for those that did not (Figure 1). Clearly, the marginal effect (slope) of *production and sales experience* on future sales is greater if the firm entered the new niche ($p < 0.01$). Indeed, because of the scaling effect of the other variables and the constant, the coefficient for *production and sales experience* would need to fall from 1.01 to 0.09 before future sales would have the same effect whether or not a firm entered a new market. We find no evidence that prior transition experience had a significant effect on sales, regardless of whether the firm entered a new niche.

The analysis also allows us to consider the counterfactual case. That is, we can estimate how a different choice might have affected sales. Figure 1 also

presents this estimation, which is depicted for firms at risk to enter the 5.25″ market and taken at the median value of all variables in the appropriate sample.[8] Note that our analysis suggests that firms that chose to enter the new market increased their sales by doing so. We estimate that their average future sales would have been about 87,000 units if they entered the 5.25″ market and 6,000 units if they did not, given their level of static experience (which was higher than the nonentrants'). Thus, we cautiously conclude that these firms benefitted from entry.

We find evidence that the average firm that chose not to enter the 5.25″ market would have had higher sales had it entered (18,000 versus 3,000 given their level of static experience, which was lower than the entrants'). Given this, we might infer that some of the firms that failed to enter should have done so, and that on average more experienced firms made better

[8] Figure 1 does not include the effect of the inverse Mills' ratio (lambda) due to the interpretation of the maximum-likelihood method of generating it. This, however, does not change our results or interpretation. Lambda's contribution to the magnitude of future sales estimates, slopes, and comparisons across the performance models was minimal.

decisions than less experienced ones. Such an assertion ignores the costs of entering and potential competitive equilibrium effects. That is, while our analysis suggests that nonentrants would be better off entering, it is probable that entering would have reduced the payoffs for everyone in the new niche and thereby made entry unprofitable. If less-experienced firms indeed missed new market opportunities, it might suggest that experience in previous markets actually helps managers analyze new market opportunities (Langlois 1997). Just as technological experience can increase understanding of new technologies (Cohen and Levinthal 1990), so market experience may increase some firms' understanding of new markets. Thus, some nonentrants may have fallen victim to what Langlois (1997) calls a "Type II error in perceiving market opportunities," that is, managers lacked the experience needed to fully understand the opportunity. Alternatively, unobserved resource constraints may have prevented these firms from entering new niches.

In summary, we do not support predictions that experience leads to organizational inertia. We do not find evidence in support of Hypothesis 1 that static experience will discourage market entry. We do not support our hypotheses that transformational experience will affect market entry. We do, however, find support for our hypothesis that static experience provides greater sales in new market niches, and that firms with more of such experience are more likely to enter. Thus, we infer that managers recognize the value of different types of experience and initiate market entry when such experience provides an advantage.

5. Discussion

Our research seems to contradict both general and specific research on the response to new market niches. What may explain the difference in our findings? Three explanations seem most probable. First, unique characteristics of the disk drive industry may cause the divergence of our findings. In our study, each new market poses a threat to all previous market niches, and research has shown that market jolts and threats may increase both the probability and value

of change (Mitchell 1989, Tushman and Rosenkopf 1996). In the disk drive industry, each new market niche appeared close on the heels of a previous one. In contrast, previous studies have often emphasized industries where market transitions were separated by long stable periods. Rapid changes in the industry itself may also have directly prevented the development of organizational inertia (cf., Eisenhardt and Martin 2000). This may have reduced the inertial effect of static experience and diminished the degree to which transformational experience could marginally increase a firm's dynamic capability.

Second, our research goal differs from that of several previous studies (e.g., Christensen 1997, Starbuck 1988). Many other studies emphasized the enumeration and description of possible pathologies. In response to expectations of rational management, these studies sought to demonstrate that managers might err in their response to new market opportunities and to show why managers made these errors. In contrast, our study attempts to discover whether such errors are systematically related to important independent variables.

Finally, our research is consistent with some studies of the disk drive industry (e.g., McKendrick et al. 2000), but it seems to contradict others. Examined more closely, however, our work supplements rather than contradicts these previous studies. For example, Christensen and Bower (1996) investigated why the rank ordering of the very top firms shifted across the multiple market transitions. They found that in a handful of top firms, organizational inertia delayed internal development of disk drives for new markets. Our research does not (and our methods cannot) try to explain the origin of a single-market leader, rather it extends these studies of market leadership. It shows that for most incumbent firms, experience increased the value of entry into new markets and also encouraged entry into those markets. In essence, we argue that for most firms, experience expanded the choices available to managers, and that this more than compensated for any inertia that was also created. Of course, at some level, the inertial effects of experience may overwhelm the capabilities provided by experience. It is possible that in leading firms, experience begins to have a net inertial effect, and this might

explain why industry leaders sometimes fail to retain their dominant position in new markets.[9]

Our research suggests the value of multiple empirical methods. Chesbrough (1999c) argues that scholars often must choose between larger samples with less rich measures and smaller samples of richer variables. Studies that analyze the full population of firms cannot uncover the rich internal processes within a small group of firms. However, case studies of firm difficulties can neither reveal central tendencies across the full population, nor determine the economic importance of the pathologies observed. Both types of studies are needed.

Our research is also consistent with other studies—particularly those on the importance of "complementary assets" in helping firms to survive technological or market transitions (Teece 1986, Tripsas 1997). We expand this literature by adding experience as an important asset, by considering counterfactual cases, and by evaluating more than the possibility for survival. Because experience is hard to obtain through market transactions, its value provides additional support for theories that complementary assets are important to incumbent success after technical or market transitions. Such experience both affected the value of attempting a market transition and the tendency to do so. Thus, we infer that managers are aware of the value of such assets and factor them into their decisions.

6. Conclusions

In this paper, we have extended the growing literature on dynamic capabilities by elaborating the link between experience and dynamic capabilities. We differentiate among different orders of experience, and

we compare two perspectives on the role of managers in determining dynamic capabilities. In one industry, we analyze 20 years of data on the full population of firms and employ statistical methods to differentiate the effect of different strategic choices. We do not support theories that experience leads to constraining inertia in the organization or in its management. Rather, we find that sales experience in one market niche provided a competitive advantage in new market niches, and thereby encouraged managers to enter these niches. Thus, moderated by the choices of managers, experience that should have impeded market entry actually encouraged it.

Our research casts doubt on the notion of a trade-off between static experience and dynamic capability. Scholars increasingly argue that modern business conditions no longer benefit firms that attempt to use production economies to compete in existing markets (Garud and Kumaraswamy 1995). What is needed instead, they argue, are dynamic capabilities and transformative capacity (cf., Garud and Nayyar 1994, Kogut and Zander 1992, Henderson and Cockburn 1994). Our research suggests that elaboration of production and sales for one set of customers need not restrict the organization's ability to adapt. Indeed, our results suggest that static experience can lead to dynamic capability. As a result, firms may benefit both from their production experience and from the dynamic ability this experience provides. It should come as no surprise then that 8 of the top 10 disk drive producers in 1995 had entered in a preceding format. Five had first entered the 14" market.[10]

One might think that as technological change increases the frequency of new market waves, the era of incumbent firms is over. In this view, Schumpeter's (1934) first model of "creative destruction" would now be correct—each new wave washes away firms from a previous generation. Our work suggests caution in adopting this view, and matches his later observation that incumbent firms can survive waves

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[9] We also ran a random effects logistic regression model with a dummy variable for the top five firms from each previous transition. We did not find significant evidence that the top five leading firms were slower or less likely to enter, but this could be due to the small sample of leading firms. It may also be possible that trends in the industry changed after the 3.5" drive. While we have no reason to believe this is true (large incumbents from 3.5" appear to have dominated the early markets in both niches), we must emphasize that our statistical analysis ends in 1995, well before the 2.5" and 1.8" drives played out in the market.

[10] One of the new firms, Conner Peripherals, is also an entrant in name only. The company was bankrolled by Compaq which for several years bought 70% of its output. The other new entrant was Samsung Electronics.

of creative destruction. At least with respect to market niche transitions in one industry, our work suggests that incumbents can survive because they have valuable experience and because their managers use this experience to navigate the market waves, despite rapid technological and market change.

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