HOW PERFORMANCE RELATIVE TO ASPIRATION LEVELS AFFECTS STRATEGIC RESPONSE TO TECHNOLOGICAL DISCONTINUITY

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ABSTRACT

We investigate how performance relative to aspirations affects firm response to a technological discontinuity by examining how incumbent firms in the U.S. computer industry responded to the introduction of the Personal Computer. We find that firms performing further below and further above their aspirations were more likely to adopt the new technology. Among adopters, those performing below historical aspirations were more likely to abandon their product strategy, while firms performing above aspirations pursued a hedge strategy by adding the new platform without abandoning their previous one.
INTRODUCTION

Organizational scholars have noted that industries tend to experience periods of relative stability, that are interrupted from time to time by jolts in the environment that change the rules of competition or establish new industry paradigms (Haveman, Russo, & Meyer, 2001; Meyer, Brooks, & Goes, 1990). These jolts typically come in the form of industry-shifting innovations of various kinds including competence-enhancing and competence-destroying discontinuities (Tushman & Anderson, 1986), architectural innovations (Henderson & Clark, 1990), and disruptive innovations (Christensen, 1997; Christensen & Bower, 1996). While these innovations differ in form and effect, all involve the sort of event addressed in the punctuated equilibrium perspective (Romanelli & Tushman, 1994; Tushman & Romanelli, 1985), and fuel the engine of creative destruction that dramatically alters industry landscapes (Schumpeter, 1942).

A critical question of interest to management scholars is how firms respond to these technological discontinuities. For some firms, these dramatic changes in the environment trigger equally dramatic adjustments in the organization, yet other firms fail to respond at all, which is often a precursor to organizational decline or failure. Much of the research in this stream has pointed out that for a variety of reasons incumbent firms in particular are thought to be slow to react to these discontinuities. For example, incumbent firms experience high levels of organizational inertia and typically prefer to engage in activities that exploit current knowledge rather than explore for new knowledge and capabilities (March 1991). This emphasis on exploitation is a form of organizational myopia (Levitt 1975, Levinthal & March, 1993), and can lead firms to become caught in competency traps (Levinthal & March, 1983). In addition, managers often have strong preferences to remain committed to the status quo rather than engaging in more uncertain change efforts (Geletkanycz & Black 2001, Samuelson & Zeckhauser 1988). Yet despite these inherent obstacles to change, we know that some firms are able to react and successfully adapt to a new environment. For example, IBM survived the demise of both the typewriter and adding machine and has reinvented its product line and strategy on multiple occasions in order to survive and prosper through radically different technological eras (Maney & Collins, 2003). Understanding why
some firms do respond to a technological discontinuity and how they do so are important questions in the field. However, most research has focused on the characteristics of firms that are successfully able to adapt. For example, valuable research into dynamic capabilities (Eisenhardt & Martin 2000) and organizational ambidexterity (March, 1991) has helped clarify how organizations might successfully navigate in a new environment, but the focus is on the ability to change rather than the motivation to enact change in the first place. Better understanding the motivational aspects of organizational response to discontinuities is critical to fully understanding the phenomenon of strategic organizational change.

One of the biggest motivators for change for both individuals and firms is consideration of how well they are performing relative to some aspiration level, or reference point. A large body of work suggests that the likelihood of change can differ dramatically depending on whether current performance is above or below that point. For example, theories of failure-induced change such as prospect theory suggest that individuals in a loss position are more likely to take risks than when in a neutral or gain position (Kahneman & Tversky, 1979). Out of this stream of research has emerged a literature at the organizational level that examines how firm performance relative to aspirations (determined by prior performance or social comparison) influences strategic choices and actions. Research has shown that firms performing below their peers or below their own historical levels are more likely to take risks and change strategies relative to firms performing at or above their aspirations (Greve, 1998; March, 1988; March & Shapira, 1992). This is consistent with the notion of problem-directed search in which firms satisfice by maintaining the status quo until confronted with direct evidence that the current approach is not working (Cyert & March, 1963). At the same time, this research finds that firms performing above aspiration levels tend to be risk averse and avoid significant change.

However, a number of seemingly contradictory findings and theories suggest that high relative performance may actually increase the likelihood of change. For example, a recent study about the incidence of corporate illegality describes a number of mechanisms, such as the house money effect, the red-queen effect, and managerial hubris, that can induce firms performing above aspirations to engage in more risky behavior (Mishina et al., 2010). Middle-status conformity notions (Phillips & Zuckerman,
2002) also support the idea that as performance improves above some benchmark the willingness to
deviate from common practices can also increase. Other arguments taken from a threat-rigidity
perspective suggest that managers tend to categorize events as threats or opportunities and that such
categorizations can help motivate change (Gilbert, 2006; Staw, Sandelands, & Dutton, 1981). Scholars
have generally viewed these theories and mechanisms as being opposed to theories of problem-induced
change rather than complementary perspectives.

In this study, we aim to integrate a number of these seemingly contradictory perspectives with the
ideas of failure-induced change in the context of a technological discontinuity. Due to its dramatic effects
on an industry, technological discontinuities create a great deal of uncertainty (Tushman & Anderson,
1986) and create a type of natural experiment that allows us to first test how relative performance
influences the likelihood of an organizational response. In addition, we are able to conduct a more
detailed assessment of how prior performance might affect not only the likelihood of response, but also
the nature of the response. For example, in responding to a technological shift a firm might entirely
abandon a prior product strategy (a radical strategic action) or might engage in a hedging strategy by
adding new products based on the new technology while retaining current products based on alternate
technologies (a more incremental strategy). Examining the likelihood of incremental versus radical
strategic actions (Dewar & Dutton, 1986; Henderson & Clark, 1990) provides another avenue for better
understanding how prior performance might shape the strategic actions of firms, beyond simply a
prediction of action or inaction.

We test our framework by examining the response firms had to the introduction of the IBM
Personal Computer (PC) in 1981, a potentially disruptive innovation (Christensen & Raynor, 2003;
Christensen, 1997; Christensen & Bower, 1996) that introduced a technological discontinuity in the
computer industry. The rapid acceptance of this product design into the market and its open-standard
nature allowed other companies to introduce compatible products and triggered a dramatic change in the
computer industry, the impact of which is still felt decades later. As such, it fits well the definition
adopted by Haveman and colleagues for punctuating events as those which “rewrite the rules of
competition and the norms of co-operation, and dramatically alter performance outcomes industrywide” (Haveman et al., 2001: 253). At the time, firms within the industry were faced with the critical decision of whether to offer IBM PC-compatible computers or to continue with their current technologies. In the years following the IBM PC introduction, more and more firms adopted this standard, and it quickly became the industry’s dominant design (cf. Tushman & Anderson, 1986). But at the same time, many firms did not adopt this new technology, suggesting that only some organizations perceived opportunities to capitalize on the booming demand for products based on the new standard. Moreover, we are able to observe differences in the type of strategic response by incumbent firms: some abandoned their prior strategy (a radical response) while others attempted to sustain prior product lines for some period of time and simply added PC-compatible products to their overall product portfolio (an incremental response). This study examines whether (and how) firms changed technology paths by adopting the IBM PC standard and how such adoption patterns were influenced by prior performance relative to aspirations.

ASPIRATION LEVELS AND THE LIKELIHOOD OF ORGANIZATIONAL CHANGE

Problem-Induced Search, Risk Aversion and Strategic Response

In developing predictions regarding the likelihood of a strategic response to a disruptive technological change we first consider the case where a firm is performing below some relevant performance target or threshold. Research on aspiration levels suggests that judgments regarding firm performance are made relative to social and psychologically based targets rather than from a rational economic analysis of performance maximization (March, 1988; March & Shapira, 1992; Mezias, 1988). Performance below an aspiration level results in dissatisfaction that prompts decision makers to make changes to the organization’s status quo. Conversely, performance above an aspiration level is deemed to satisfice, so few if any changes are sought. In considering performance benchmarks, both historical and social aspiration levels have been considered in the literature (Bromiley, 1991; Greve, 1998, 2003; Harris & Bromiley, 2007; Mishina, Dykes, Block, & Pollock, 2010). History-based aspirations are influenced by a firm’s current performance relative to its prior outcomes. For example, firms suffering lower sales...
growth compared to prior years might interpret this as cause for concern. Decision makers also engage in a social comparison process in which a firm is compared to organizations that are similar, for example, in size, industry, or location. Thus, a firm experiencing sales growth below the industry average, which serves as a social aspiration level, may judge its performance as unsatisfactory and seek changes to remedy that performance shortfall.

Research on aspiration levels links these performance assessments relative to aspirations to psychological theories of failure-induced change. Prospect theory suggests that individuals are willing to assume more risk when operating in the domain of losses or below aspiration levels (Kahneman & Tversky, 1979). In such instances, people are generally willing to take greater risks to recoup earlier losses than to preserve a gain of equal magnitude. Firms that perform poorly therefore have greater motivation and willingness to search for solutions and to make changes as they attempt to correct poor performance.

Similarly, the notion of problem-directed search introduced by Cyert and March (1963) suggests that decision makers are generally reluctant to search for alternative courses of action unless they are motivated by a salient performance shortfall. For example, Greve (2003) found that as firms perform further below aspiration levels, they are more likely to engage in research and development and produce new innovations. This effect is predicted to be non-linear, such that as performance moves from the relatively neutral break-even territory to bigger losses, the willingness to take chances increases more rapidly (Kahneman & Tversky, 1979). This behavior is akin to betting on a long shot during the last horse race of the day in an effort to recoup earlier losses. In all likelihood, such a bet will put a gambler even further in the hole, but the slim chance of breaking even or coming out ahead is enough to entice the gambler, almost regardless of how large his or her losses have been. As this suggests, the magnitude of the shortfall below one’s aspirations has a limited effect on the likelihood of change once the actor is clearly in the domain of losses. Once is this range, the willingness to make changes is relatively high throughout the range of below-aspiration outcomes.
In contrast, when performance is very near the level of aspirations, decision makers become highly attuned to the potential for losing their tenuous position near their targets. Thus, even within the domain of losses, performance that is close to aspirations should result in external stimuli being more likely viewed as threats rather than opportunities. Whether the perceptions of threat dominate because the magnitude of potential upside is relatively small (because the firm is close to the target) and the possible downside is great, more typical threat rigidity responses may come into play. It is in this case where “a general tendency for individuals, groups, and organizations to behave rigidly in threatening situations” (Staw et al., 1981: 502), is most likely to occur. Perceptions of decreased control and influence (Jackson & Dutton, 1988) are more likely to undermine motivation to engage in meaningful strategic change. Rigidity manifests itself either through stasis and inaction or through a redoubling of efforts that are consistent with current approaches (Ocasio, 1995), leading to increased organizational momentum (Miller & Friesen, 1980). Whether the outcome is immobility or reinforcement of the status quo strategy (D’Aveni 1989; D’Aveni & MacMillan, 1990), both act in opposition to fundamental changes in an organization, such as the adoption of a new technology.

Middle status conformity theory (Phillips & Zuckerman, 2001) also suggests that near the level of aspirations, firms are most likely to commit to the status quo. They do not want to risk what success they already have by gambling on a new strategy. In this context, status is assessed in terms of acceptance by customers (i.e., sales) and as long as sales seem to be stable, firms may not want to risk alienating the customers by making a shift. Therefore they display classic signs of risk aversion as discussed in the examples above. It is only when performance falls significantly, and the firm’s status is clearly in jeopardy, that they will consider altering their strategy. Taken together, these arguments suggest that firms will be more likely to respond to a technological discontinuity as performance declines below aspiration levels. At the same time, we expect a lower likelihood of change when performance is close to aspirations. Thus, our first hypothesis predicts the following:

*Hypothesis 1: The further performance falls below aspirations relative to social and historical referents, the greater the likelihood of adopting a new technology path in response to a technological discontinuity.*
Threat Rigidity and Opportunity Framing

As discussed above, it is possible that how a firm’s managers frame a situation — whether as an opportunity or threat (Dutton & Jackson, 1987) — may influence response to technological change. Opportunities, which are characterized as potential gains, are associated with an increased sense of control and a greater perceived probability of success when implementing a new strategy (Jackson & Dutton, 1988). Managers of firms that are performing above social and historical aspiration levels may be more likely to frame a technological discontinuity as an opportunity rather than a threat. Firms performing above aspiration levels can be considered to be operating from a “gain” position (in the language of prospect theory) and may therefore be more likely to interpret external stimuli as potential sources of additional gain. Because opportunity framing is associated with increased perceived competence, managers whose firms have performed well relative to aspiration levels may perceive higher levels of competence which would make them believe that they have more ability to control the situation and respond successfully. Unlike threat rigidity situations in which managers restrict search and focus on internal efficiency, managers are more likely to pursue novel actions in response to perceived opportunities (Dutton & Jackson, 1987).

It is also possible that the discontinuity is sufficient to invoke some sense of threat, in spite of the firm’s success, and trigger enough concern to motivate change without invoking rigidity. Similar to the notion of holding competing threat and opportunity framings in the domain of lower performance, described above, the same may be happening above aspiration levels. The simultaneous, or nearly simultaneous framing of a situation as a threat and an opportunity, can lead to a high degree of flexibility, and commitment to pursue radical action (Gilbert, 2006). In the setting of the personal computer industry in particular, the introduction of a new standard coincided with a dramatic increase in demand for personal computers. This environmental shift may have been interpreted simultaneously as an opportunity (fostering optimism and confidence) for continued growth by firms already experiencing high
performance relative to aspirations and as a threat (strong enough to motivate action, but not enough to lead to rigidity), resulting in an increased likelihood of adoption.

Furthermore, middle-status conformity (Phillips & Zuckerman, 2001) suggests that those performing much higher than aspiration levels are likely to feel able to deviate without risk of sanctions. While those firms performing very close to, but slightly above aspiration levels are still likely to feel pressure to conform and be averse to the risk of the unknown upside of a new strategy. This psychologically liberating effect on decision makers creates additional incentive to pursue strategic change when performing especially well relative to aspirations. This is particularly true when that performance is measured against peers with a metric (such as sales growth) that allows the executives to consider their firm a leader in the industry. In summary, the middle-status conformity and opportunity-framing perspectives offer logic to predict the behavior of firms performing above aspirations when firms are confronted with a technological discontinuity. Thus, we offer the following hypothesis:

Hypothesis 2: The further performance rises above aspirations relative to social and historical referents, the greater the likelihood of adopting a new technology path in response to a technological discontinuity.¹

To summarize, we have argued that failure-driven search creates a negative relationship between a firm’s performance relative to aspirations and its likelihood of change. In addition, opportunity framing create a positive relationship between performance and change. These predictions are summarized in Figure 2.

Wholesale versus Incremental Strategic Responses

In cases where firms do respond to technological discontinuity by adopting a new strategic path, firms may also differ in the adoption strategy. For example, adopters of a new technology may entirely abandon their prior product technology, or they may maintain old product lines and simply supplement

¹ Because the theoretical mechanisms proposed to be operating in the above- and below-aspirations are distinct, a non-linear shift in the relationship is expected at the transition between these regions. Therefore, separate hypotheses are presented and tested.
their prior strategy with the addition of a new product technology. The first approach suggests a radical shift in strategy, in which the future success of the business hinges entirely on the success of a product new to the company. The second incremental strategy would allow firms to play in multiple markets until the final outcome of the technological discontinuity is fully known and delay the internal decision regarding a commitment to a single technological platform. In this way, firms could use product diversification as a type of hedging strategy to reduce risk by spreading investment over multiple product domains (Hoskisson & Hitt, 1988).

The hedging strategy is consistent with a real-options approach to technology development. From a real options perspective, firms can make incremental investments in new technology in ways that minimize the level of resources committed to a course of action until market or technological uncertainties are reduced. Firms create technology options by making initial investments in the development of a technology, and then exercise the option for that technology through further investment or commercialization (McGrath, 1997). In a sense, firms that added a new PC-compatible product line were purchasing an option on this new technology standard while retaining the option of maintaining their prior product lines. This would leave them free to make future investments in whichever technology had market opportunities sufficient to produce attractive returns. Given the uncertainty surrounding a technological discontinuity, such an incremental approach may have been especially attractive to firms.

Once again, performance feedback is likely to impact the decision of which strategy to pursue. Past research has shown that prior success reduces the likelihood that firms will engage in strategic change (Audia, Locke, & Smith, 2000). However, as discussed above, above-aspiration performance may also foster an opportunity focus among managers (Dutton & Jackson, 1987), which could encourage pursuit of novel product strategies. To the extent that both of these forces are at work, firms operating above aspiration levels may manifest both effects simultaneously. Should a firm already performing well (i.e., above aspiration levels) decide to pursue a strategic change, it is unlikely to entirely abandon what would appear to be an effective strategy over the recent periods. Because performance is still relatively strong, it is still likely that firms have less incentive to explore alternatives and enact significant changes
because they are not motivated by a salient problem (Kiesler & Sproull, 1982). Thus, an incremental strategic change may be more consistent with any tendency toward satisficing behavior and some lingering commitment to the status quo. Therefore, such firms would be more likely to take an incremental approach by adding a new technology while maintaining prior product lines, at least in the short term. In addition to the psychological effect of performance above aspirations, the retention of profitable existing business lines may create the expectation of slack reserves (Chen, 2008; Levinthal & March, 1981) that could be used to fund the launch of an additional product.

However, when a firm performing below aspiration levels decides to change strategies, it will be more likely to abandon the failing strategy and fully redeploy resources to pursue the new strategy. Given the choice by a firm operating in the domain of losses to make a strategic change, we can assume that prospect-theory logic (Kahneman & Tversky, 1979) is likely to apply. That is, given the fact that the firm is operating in the domain of perceived (and perhaps actual) losses, they are more likely to be willing to take larger risks. Because the firm’s survival is at risk, managers may readily make larger bets on an entirely new strategy that allows for maximum upside potential. Abandoning a failing strategy also allows redeployment of firm resources to the new endeavor, and therefore minimizes the need to acquire additional capital, which may be difficult for a firm with declining performance or lower performance relative to peer companies. The logic outlined above leads to the following predictions:

Hypothesis 3a: The further performance falls below aspirations, the greater the likelihood that the firm will respond to a technological discontinuity by entirely abandoning their prior strategy and switching to a new technology path.

Hypothesis 3b: The further performance rises above aspirations, the greater the likelihood that the firm will respond to a technological discontinuity by supplementing their prior strategy with the addition of a new technology path. ²

METHODOLOGY

Setting

² The predictions here address the relative likelihood of the specified entry strategy versus both no action, and relative to the alternative mode of entry (abandonment or supplementing). That is, H3a is predicting that an abandonment strategy is more a more likely outcome relative to no action and relative to a supplementing strategy.
To test our hypotheses we consider a major technological discontinuity that reshaped the computer industry, the introduction of the DOS-based Personal Computer by IBM. Prior to 1981, the microcomputer industry had been dominated by a number of proprietary systems, many of which had not been widely adopted. Apple’s products were achieving some prominence by the late 1970s, but were still viewed as recreational computers not suited for business use. In 1981, IBM triggered a dramatic shift in the landscape with the introduction of a new Personal Computer. IBM developed the PC using off-the-shelf components, adopted an open architecture and published detailed specifications and blueprints so that other firms could create compatible systems. IBM’s adoption of the freely available DOS operating system from Microsoft provided a common platform for all makers of PC-compatible computers. This also prompted large numbers of software developers to create software for this platform, and as adoption grew, network externalities increased, benefiting both users and developers (Katz & Shapiro, 1985). In retrospect, the concurrence of these factors opened the way for the rapid emergence of a dominant personal computer design.

This coincidence of events provides a unique setting to test our hypotheses. There were a number of companies already in the industry prior to the introduction of the IBM PC architecture. Although not an immediately transforming event, such as a massive labor strike (Meyer, 1982), this change was discontinuous to the extent that over a relatively short period it did alter the rules of competition and the norms for cooperation (Haveman, 1993; Meyer et al., 1990). The impact of the discontinuity was not immediately clear, and was undoubtedly subject to ambiguous interpretations about the importance and impact of this change; however, many incumbent firms and new firms quickly adopted the PC-compatible platform. Further, because this discontinuity involved an open architecture and a standard that other companies could inexpensively and easily adopt, we are able to assess firms’ motivations to change, which is our theoretical focus, rather than their technological capacity to change, which is theoretically distinct. Because of the openness of the architecture and its ease of replication, we are able to assume that the decision to adopt PC-compatible technology was seldom hindered by a lack of technical capabilities.
Our sample includes all businesses in the U.S. microcomputer industry (including personal computers) from the founding of the industry in 1975 through the year 1986. These firms included makers of microcomputers (e.g., the Apple Macintosh) and desktop and desk-side personal workstations (e.g., Sun Microsystems’ SPARCstation). Data were drawn from a census listing purchased from the International Data Corporation (IDC) of all domestic firms and foreign subsidiaries that built such computers in the United States. Those listings were updated annually and provided dollar sales and some technical information on all models of personal computers that were introduced during the study period. Because the phenomenon of interest is the response to introduction of the IBM PC standard, firm-year observations begin in 1981 and continue through 1986. By 1986 the dominance of the IBM PC standard was clear, and beyond 1986 the dynamics of the market changed with the introduction of PCs based on Intel’s 80386 processor and IBM’s launch of its PS/2 line in 1987 (Ichbiah & Knepper, 1989). Thus, this time period provides a window during a relatively stable period in terms of system architecture.

To isolate responses to environmental change, we consider all firms in the industry prior to 1981 when the IBM PC standard was introduced, as well as firms that entered after 1981. Because the phenomenon of interest is a technological change indicated by introducing a PC-compatible product, all incumbent firms in the industry prior to 1981 were at risk of changing technologies by adding PC-compatible products to their lines. Similarly, new entrants after 1981 that did not initially sell PC-compatible products were also at risk of responding. In contrast, newly founded firms were not at risk of changing technologies until their second year of operations, so their first-year observations were excluded. Similarly, new entrants that immediately entered with a PC-compatible product were never at risk of changing to the PC standard, so they were also excluded. In supplementary analyses not shown below, such observations were included, with no significant effect on the results. In total, there are 164 firms in the sample, with 494 firm-years of observations and 44 entry events. Those observations included all years up through the first year in which a firm introduced an IBM PC-compatible product, failed, or were right censored in 1986 when the study window ends.
Dependent Variable

Market entry was coded as a dichotomous variable, with a value of 1 for the first year in which a firm had sales of IBM PC-compatible systems as recorded in IDC’s sales data. For all other observations this variable was coded 0. When considering the type of entry, as discussed in the third set of hypotheses, entry into the PC market was further classified into one of two categories: market entry – supplement (for firms that continued to sell a non-PC product after launching a PC product) or market entry – abandon (for firms that abandoned all prior microcomputer products when launching a PC product).

Independent Variables

Performance relative to social aspirations or historical aspirations was measured using a spline function, with separate variables coded for performance above and below a historical or socially based target level (Greve, 1998; Henderson & Stern, 2004). With historical aspirations, a firm compares its recent performance to its earlier ones. With social aspirations, a firm compares its recent performance to the average of other firms in the same industry. Performance relative to historical aspirations was measured as the fractional change of sales between $t$ and $t-1$. Prior performance below aspirations equaled the absolute value of this change when it was negative, and 0 otherwise. Performance above historical aspirations was unbounded because sales can—and frequently did—increase by more than 100 percent in a year, so the natural logged value of the fractional change (plus 1) was used to reduce skewness. Social measures equaled the fractional change in sales between $t$ and $t-1$ for the focal firm minus the corresponding value for the entire industry excluding the focal firm. Prior performance below social aspirations equaled the absolute value of that difference when it was negative and 0 otherwise. Prior performance above social aspirations equaled that difference when it was positive and 0 otherwise. Again, this variable was transformed by the natural log in the case of performance above aspirations to reduce skewness. All measures incorporated a one-year lag.

Control Variables
Pre-shock entrant. In order to isolate the effects of predictor and control variables on incumbent firms already in the industry at the time of the shock, we coded a dummy variable, pre-shock entrant, as 1 for all companies that had sales in the general personal computer or workstation market in 1981 or earlier.

Multi-business firm. In some cases the computer business was a subsidiary or division of a larger organization. Although a multi-business firm may have greater breadth of capabilities and market ties, enabling responsiveness to environmental change, the complexity of the organization may also impede change (Fombrun & Ginsberg, 1990). Although we do not make explicit predictions about this effect, we control for possible differences in responsiveness due to being an independent, focused computer business, versus one of a number of businesses under the same parent umbrella.

Age. Because firm age has a number of potential effects on organizational performance as well as action, we controlled for the age of the computer business (as well as age squared where significant). As firms age they may become more inertial as processes and routines become harder to change (Hannan & Freeman, 1977, 1984). On the other hand, older firms have more experience and opportunity to develop relevant capabilities that may increase their responsiveness. Where the computer business is part of a multi-business parent firm, we also control for parent age to control for the effects of age and experience beyond the short history of the microcomputer industry.

Size. Similarly, we control for the effects of firm size, which may insulate firms from the impacts of environmental jolts because of the availability of slack resources. Firm size may also be an indicator of organizational inertia and decreased likelihood of change. Size was operationalized as the total sales of the microcomputer business unit (obtained from IDC), where it was a stand-alone business, or the total sales of the parent firm (obtained from COMPUSTAT), where the computer business was the subsidiary of a larger firm. The natural log of sales was used to reduce skewness. Values were also lagged by one year.

Number of models. Because the breadth of a firm’s product portfolio can influence future performance by providing a firm with market data and feedback (Sorensen & Stuart, 2000), we control for the number of models offered by a firm in a given year, based on a count of models listed in the IDC data.
This variable was lagged by one year. Experience in introducing products and managing larger product lines may make it easier for firm to introduce a new product. In contrast, larger portfolios may also be associated with greater operating complexity since there are more potential interdependencies to consider (Thompson, 1967) potentially slowing a firm’s responsiveness to external developments.

*Return on sales (ROS).* As an additional test for possible effects due to the performance of the firm we included return on sales, which equaled net income divided by sales. These annual measures were obtained from COMPUSTAT, and were therefore only available for publicly traded firms. Thus, this is a measure of corporate performance rather than a measure of the financial performance of the focal business unit. For the private firms not listed in COMPUSTAT, this variable was coded 0.

*Probability of failure.* Because some firms failed or exited the industry during the observation window from 1981 to 1986, it is important to control for possible sample selection bias. If some firms are generally unresponsive, not only to industry change but also to customer needs, they may be more likely to fail. To control for this possibility of heterogeneity, we utilized a two-stage Heckman procedure (Heckman, 1979), estimating the probability of failure in the first-stage model. In this case, a failure was identified as the last year a firm had sales in the microcomputer industry (and thus the last year the firm appeared in the data set). The predicted probability of failure for each firm-year observation is then included in all of the second-stage models to isolate our hypothesized effects from those that may have increased the likelihood of a firm exiting the industry. The key independent variables (performance relative to aspirations) were included in the first-stage failure model (although they were not significant) to ensure robustness. In the interest of brevity, failure model results are not reported but are available from the authors upon request.

*Industry density.* Because the number of firms competing in an industry affects the level of competitive intensity, resource munificence, and likelihood of failure (Hannan & Carroll, 1992) we included a control for the industry density. This was a period of rapid growth in the industry, coincident with the widespread adoption of IBM PCs as the personal computer. This had a signaling effect, making the impact of the change in the environment more salient and indicating a lower risk of customer adoption
over time. In supplementary analyses, the density of prior adopter firms offering PC-compatible products in each year was substituted. This was highly correlated with total industry density (r = .96) and did not alter the results. In both cases, density measures were lagged by one year.

**Estimation and Modeling**

To test our hypotheses regarding adoption of PC-compatible technology, we used discrete-time event history analyses with complementary log-log models. Such models account for both (a) the continuous nature of the phenomena (a firm might first offer an IBM-compatible product at any time during the year), and (b) the discrete nature of the data, which were recorded on annual basis only by IDC. We used similar models in the first stage of the Heckman procedure, which estimated the probability of organizational failure. Tests for Hypotheses 3a and 3b utilize a multinomial logit models (So & Kuhfeld, 1995) to simultaneously test relationships between regressor variables and competing outcomes for the dependent variable (no entry, entry by supplementing prior products, and entry by abandoning prior products).

**RESULTS**

Descriptive statistics for all variables are reported in Table 1.

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INSERT TABLE 1 ABOUT HERE

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We estimated a set of nested models predicting entry into the IBM PC-compatible market, which are reported in Table 2. In Model 1, we included only firm-level and industry-level control variables and the probability of failure, as estimated in a separate first-stage model. Models 2 and 3 include independent variables. In both cases, the addition of the performance relative to aspiration variables significantly increases the model fit. Examining the effects of the control variables, we find that firms with a larger product portfolio and an older parent firm were more likely to enter the PC-compatible market. Again, as expected, the density of firms in the industry market increased the likelihood of entry.

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INSERT TABLE 2 ABOUT HERE

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Due to their strong correlations, we assessed the effects of performance relative to historical and social aspirations in separate models. Model 2 reports results from tests involving social aspirations, while model 3 used historical aspirations. Results are similar across both models, although the performance below social aspirations is only marginally significant ($p < .10$). We find support for the prediction that when firms are performing below aspirations, the likelihood of entering the PC-compatible market increases as performance declines. This supports Hypothesis 1. In contrast, we find that in the domain of performance above aspirations, the better a firm performed relative to aspirations, the more likely they were to enter the IBM PC-compatible market. In this case, Hypothesis 2 is supported. Graphing these results produces a v-shaped relationship, with firms closest to their aspirations levels (either above or below) being the least likely to respond to the new IBM PC standard by entering that market. As Figure 3 shows, the slopes are significantly different and of opposite signs for performance above and below aspiration levels, indicating the appropriateness of a spline function to test these hypotheses.

We conducted additional analyses to explore the possibility of a curvilinear relationship above or below aspiration levels. For example, Sitkin (1992) proposed that small or modest levels of failure would induce productive learning and change; however, as performance got worse these effects would reverse and change would become less likely (i.e., threat rigidity would dominate). We found no significant curvilinear relationships for either measure of performance relative to aspirations, historical or social.

Table 3 reports results from additional reduced models to test the robustness of our results in the full models. Because the number of response events is relatively low (44 entry events), we ran several sets of reduced models with limited numbers of control variables. As Table 3 reveals, the coefficients and significance levels of the predictor variables are generally consistent. The one exception involves performance below social aspirations, which was only marginally significant in the full models shown in Table 2. Although the significance of some control variables increases, perhaps because some effects may be mediated in the full model, consistency of the predictor variables increases confidence in the main
findings. In a separate analysis of a subset of the data including only pre-1981 incumbent firms, the results were consistent with the models reported above.

To test Hypotheses 3a and 3b, multinomial logit regression models were used to estimate the relationship between the independent variables and the likelihood that a firm would select entry by either supplementing current products or by abandoning current products entirely (with no entry into the PC market as the reference category). Results are presented in Table 4. Statistically significant control variables were retained in the final models presented here. Results for the independent variables are consistent with supplementary analyses that included other non-significant control variables. In models 7a and 7b we assessed the effect of performance above or below social aspirations on the likelihood of a given strategy. Performance relative to social aspirations showed no significant relationship with entry into the PC market by either strategy. However, performance above or below social aspirations is positively related to a greater likelihood of entry by supplementing, and the difference between the abandon and supplement coefficients is significant ($p < .05$) for performance above aspirations. These findings support Hypothesis 3b but fail to support Hypothesis 3a. Models 8a and 8b test the effects of performance relative to historical aspirations. Performance below historical aspirations does show a significant positive relationship with greater likelihood of abandoning an existing product strategy to enter the PC market, consistent with Hypothesis 3a. However, these results must be interpreted with caution because the coefficients for each strategy did not differ significantly. Performance above historical aspirations shows no relationship with the likelihood of abandoning but is related to a greater likelihood of entering the PC market by supplementing existing products, consistent with Hypothesis 3b. The coefficients differed significantly ($p < .05$) in this case. To summarize, we find strong evidence in support of Hypothesis 3b, suggesting that performance above aspirations does increase the likelihood of entering the PC market by supplementing current products. We find mixed evidence relating to
Hypothesis 3a (partially supported when testing performance below aspirations, but contradicted when considering performance below social aspirations).

**DISCUSSION**

Our findings suggest that following a technological discontinuity in the PC industry, theories of failure-induced change provide the best explanation for the observed behaviors of firms performing below aspiration levels. However, contrary to the generalized predictions of the effects of performance above aspirations (March & Shapira, 1992), firms performing above aspirations also appeared more likely to engage in opportunistic search and organizational change. Because we have controlled for a number of more direct measures of performance, the positive effect on organizational change of performance above aspirations suggests effects over and above those explained by organizational slack or expertise. Further, our results provide evidence that among firms that did adopt the new technology, performance relative to aspirations helped to explain the type of adoption strategy used. Among the adopters, firms performing lower than historical aspirations were more likely to abandon their prior platform while those performing higher than aspirations were more likely to hedge by continuing with their old technologies while also adopting the new platform.

Firms performing well above aspiration levels may have been more likely to view the establishment of the IBM PC standard as a positive opportunity to be exploited. Consistent with Dutton and Jackson (1987), these firms demonstrated a bias toward strategic change and action rather than inaction as predicted by basic aspiration models (March & Shapira, 1992; Mezias, 1988). One theoretical explanation may be the phenomenon of resetting expectations (March, 1988). For example, based on historical trends of very strong performance a CEO may set an objective to increase net income by 15 percent per year. As performance well above prior results becomes the expectation, managers are more likely to engage in efforts to sustain the growth or expand the competitive lead. Such an explanation is consistent with recent research showing how performance above aspirations can lead firms to engage in illegal conduct in an effort to maintain pace with ever increasing expectations (Mishina et al., 2010).
Conversely, more stable performance at or near the level of aspirations is unlikely to induce this ratcheting up of expectations, and therefore the closer firms come to prior performance the less motivated managers may be to reach for more aggressive goals and abandon the status quo.

Another theoretical explanation may be found among psychological theories of approach-avoidance (Atkinson, 1957; Elliot & Harackiewicz, 1996), and regulatory focus (Brockner, Higgins, & Low, 2004; Higgins, 1998). Risky strategic change, such as adopting a new product strategy, is more consistent with a promotion-focused or achievement-focused perspective (with a goal of attaining success rather than avoiding failure). Although the relationship between performance relative to aspirations and regulatory focus has not been examined, prior research suggests that successful performance relative to goals may reinforce efforts to “play to win” and reach for aggressive goals (Brockner et al., 2004). This may explain the increasing likelihood of companies to launch PC products the more their performance exceeded social or historical aspiration levels. Further research directly exploring the linking between these theories may prove valuable.

More refined tests of the specific market-entry strategy utilized by firms that did launch PC products provide additional insights. As predicted, firms already performing well (above historical or social reference levels) were more likely to enter by adding products to their existing product family. Thus, although managers in these firms may be more likely to see the new product area as a growth opportunity given their relative success, evidence suggests that they are also more likely to hedge their market entry bets by retaining existing products, which may have led to their strong performance. Such products may also be utilized as cash cows to fund the launch and development of a PC product line. Only in the case of performance below historical aspirations does it appear that the preferred strategy may have been to abandon existing products entirely and completely shift the strategy to a PC product line. As discussed above, the greater the performance declines from one year to the next, the greater the likelihood of wholesale strategic change. In these situations, it may be apparent that prior strategies are inadequate and must be abandoned if the firm has any hope of survival, particularly in the face of significant changes in technologies or customer preferences. It is interesting to note that performance below social aspirations
was also associated with a supplement strategy rather than abandonment. Given the general growth of the personal computer industry, more firms tended to perform below peer firms, while still performing better year over year. Thus, existing business strategies were perhaps not indicating a decline, and therefore managers tended to retain prior product lines while introducing new products.

The collective results generally suggest an increased likelihood of strategic change the more performance exceeds aspiration levels, even when controlling for slack resources. Although these findings differ from Greve’s (1998), this may be due to several contextual differences. Organizational change in Greve’s study of radio stations reflected changes induced by relatively incremental shifts in the environment. It is possible that these environmental changes were not significant enough to be perceived as opportunities, or were not significant enough to cross the threshold of attention for managers in stations that were performing well. It is also possible that there was greater ambiguity about the appropriateness of the changes in the radio industry, leading to inaction. In contrast, in the PC industry there may have been more certainty about the potential opportunity of the PC market, particularly for firms still in business by 1986 (the end of our observation window). Analytical results indicate that greater industry density increased the likelihood of adding PC-compatible products to a firm’s product line, suggesting a strong signaling effect as more and more firms entered the market to meet growing customer demand. Tests of competing entry strategies (Table 4) show that the effect of industry density is primarily on the decision of firms to abandon prior products and switch entirely to PCs. The higher levels of adoption by competitors likely signaled both a more established market demand for PC products and declining demand for most proprietary microcomputer products, making a complete switch to PCs a more logical strategy.

Among other significant control variable predictors, it is interesting to note that computer businesses that were part of larger parent firm were more likely to launch a PC-compatible product as the age of the parent increased. Rather than becoming more inertial with age (Hannan & Freeman, 1977,

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3 Descriptive statistics confirm this, with 53.5 percent of firm-year observations indicating performance below social aspirations across all firm-years, while only 20.9 percent of firm-year observations had performance below historic (t-1) levels.
these businesses were apparently more likely to be responsive to changes in the environment. This may have been because these business units had greater autonomy from the larger parent firm because of the newness of this industry compared to the overall parent firm’s industry experience. It is also possible that there are other structural characteristics or reputation effects associated with age that enable firms to be more responsive. The size of a firm (operationalized as log of firm sales) was positively related to an abandonment strategy, suggesting that larger firms (including multidivisional firms) may have had sufficient slack resources to make a more dramatic strategic shift when entering the PC market.

It does appear that firms able to manage large product portfolios were also more likely to add PC-compatible products to their product line. Thus, a firm with four different models already in its product line was more likely to add a PC-compatible product than another firm that had only one product (but was similar on all other dimensions). Models testing specific entry strategies indicated that these firms were more likely to supplement existing products with PC models rather than abandon other microcomputer products. These findings may indicate that capabilities in product development and portfolio management enable greater responsiveness to environmental change in this industry context, combined with a tendency to retain or more gradually phase out existing products.

**Conclusion**

This study provides additional insights into our understanding of the motivational effects of performance relative to aspirations in response to changes in the competitive environment. In the area of response to technological discontinuities, this provides additional understanding of how nonstructural factors (e.g., size or age) influence organizational inertia in response to environmental shocks. This study also informs our understanding of the boundary conditions of threat rigidity. In the face of major environmental change, perhaps threat-rigidity is less common as the gap between performance and aspirations increases. This may be the result of reduced ambiguity of an industry-wide discontinuity, which enables some managers to see the folly of maintaining their current path.

In terms of implications for practicing managers, this study reinforces the need for incumbent firms to monitor the environment for significant, frame-breaking changes that may threaten their survival.
However, the most interesting implication is that managers may be least likely to initiate change when they are performing at or near expectations. Thus, counter to our intuition, managers are not at the greatest risk of stumbling when they become overconfident due to success or when they face overwhelmingly poor performance, but when they perform just as expected. In this setting, the increased likelihood of organizational inertia when performance was near the level of expectations created a competitive liability in the face of a discontinuous shift in the competitive environment. This suggests the importance of ongoing efforts to consider alternative paths for the organization, especially when performance outcomes are at expected levels.

While the uniqueness of this setting makes it somewhat difficult to generalize beyond either this technological discontinuity or this industry, it provides an important starting point for further explorations of the way in which performance feedback relative to aspirations influences managerial reactions to dramatic environmental shifts. Because the industry was still relatively young, the phenomenon may differ in a more mature industry. For example, the response to a more recent disruptive change in the computer industry such as open-source software or mobile computing devices may not reflect these same patterns given the already established dominance of existing operating systems (e.g., Windows) and applications. Additional studies of this phenomenon in other industries and settings will likely produce valuable theoretical and empirical insights into the processes by which performance relative to aspirations affects the likelihood of organizational change in response to changes in the external environment.
### TABLE 1

**Descriptive Statistics and Correlations**

| Variable                          | Mean  | s.d.  | 1     | 2     | 3     | 4     | 5     | 6     | 7     | 8     | 9     | 10    | 11    | 12    | 13    | 14    | 15    | 16    |
|----------------------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| 1. Market entry                  | 0.09  | 0.29  |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |
| 2. Market entry–abandon          | 0.04  | 0.20  | .67   |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |
| 3. Market entry–supplement       | 0.05  | 0.21  | .71   | -.05  |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |
| 4. Perf. < social aspirations    | 0.54  | 0.58  | -.02  | .02   | .04   |       |       |       |       |       |       |       |       |       |       |       |       |       |       |
| 5. Perf. > social aspirations    | 0.47  | 0.85  | .09   | -.02  | .14   | -.51  |       |       |       |       |       |       |       |       |       |       |       |       |       |
| 6. Perf. < hist. aspirations     | 0.21  | 0.32  | .02   | -.10  | .06   | .85   | -.36  |       |       |       |       |       |       |       |       |       |       |       |       |
| 7. Perf. > hist. aspirations     | 0.60  | 0.86  | .08   | -.04  | .14   | -.62  | .98   | -.46  |       |       |       |       |       |       |       |       |       |       |       |
| 8. Age                           | 4.39  | 2.24  | .13   | .13   | .06   | -.05  | -.18  | -.10  | -.17  |       |       |       |       |       |       |       |       |       |       |
| 9. Pre-IBM PC incumbent          | 0.69  | 0.46  | -.01  | -.01  | .00   | -.19  | -.05  | -.17  | .48   |       |       |       |       |       |       |       |       |       |       |
| 10. Number of models             | 1.76  | 1.31  | .21   | .02   | .26   | -.13  | -.01  | -.17  | .01   | .31   | .13   |       |       |       |       |       |       |       |       |
| 11. Multi-business firm          | 0.38  | 0.49  | .12   | .08   | .09   | .00   | -.02  | .01   | .19   | .13   | .14   |       |       |       |       |       |       |       |       |
| 12. Parent firm age              | 10.90 | 22.16 | .17   | .08   | .15   | .03   | -.01  | -.01  | -.02  | .16   | .15   | .15   | .63   |       |       |       |       |       |       |
| 13. Log of firm sales            | 2.57  | 2.86  | .16   | .07   | .15   | -.23  | -.09  | -.30  | .11   | .35   | .16   | .25   | .59   | .67   |       |       |       |       |       |
| 14. Return on sales              | 0.00  | 0.10  | .08   | .04   | .07   | -.07  | -.08  | .07   | -.07  | -.03  | .05   | .02   | .11   | .21   |       |       |       |       |       |
| 15. Prob. of failure             | 0.14  | 0.07  | -.04  | .07   | -.13  | .31   | -.01  | .39   | -.10  | .14   | -.03  | -.26  | -.40  | -.40  | -.63  | -.17  |       |       |
| 16. Firm failed/exited           | 0.15  | 0.36  | -.05  | .02   | -.09  | .06   | -.02  | .07   | -.04  | -.03  | -.08  | -.08  | -.12  | -.13  | -.19  | -.07  | .25   |       |       |
| 17. Industry density             | 142.22| 50.28 | .12   | .18   | -.01  | -.11  | -.01  | .03   | -.05  | .24   | -.43  | .15   | -.09  | -.09  | .03   | -.07  | .32   | .12   |       |

\( n = 494 \) firm-year observations.

Absolute values >= .09 are significant at the level \( p < .05 \) or lower.
**TABLE 2.**

Logistic Regression Models Predicting Entry into PC-compatible Market

<table>
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<th>Variables</th>
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<th>Model 3</th>
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**SOCIAL ASPIRATIONS**

Perf. < social aspirations   H1 (+)  0.64†

Perf. > social aspirations   H2 (+)  0.59**

**HISTORICAL ASPIRATIONS**

Perf. < hist. aspirations     H1 (+)  1.65*

Perf. > hist. aspirations     H2 (+)  0.62**

-2 Log Likelihood            262.02***  254.80***  251.85***

Δ fit (cf. model 1)           7.22*     10.92**

$n = 494$ firm-year observations. Standard errors in parentheses.

† $p < .10$, * $p < .05$; ** $p < .01$; *** $p < .001$
TABLE 3.
Logistic Regression Models (Reduced) Predicting Entry into PC-compatible Market

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<tr>
<td>Perf. &lt; hist. aspirations</td>
<td></td>
<td>1.37*</td>
<td></td>
<td>1.11*</td>
<td></td>
<td>1.44*</td>
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<td></td>
<td></td>
<td>(0.55)</td>
<td></td>
<td>(0.56)</td>
<td></td>
<td>(0.59)</td>
<td></td>
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<tr>
<td>Perf. &gt; hist. aspirations</td>
<td></td>
<td>0.53**</td>
<td></td>
<td>0.40**</td>
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<td>0.49**</td>
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<tr>
<td></td>
<td></td>
<td>(0.16)</td>
<td></td>
<td>(0.16)</td>
<td></td>
<td>(0.17)</td>
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<tr>
<td>-2 Log Likelihood</td>
<td>275.13***</td>
<td>268.21***</td>
<td>265.30***</td>
<td>283.96**</td>
<td>279.90**</td>
<td>277.75**</td>
<td>285.80**</td>
<td>277.61**</td>
<td>277.34***</td>
</tr>
<tr>
<td>Delta fit (cf. base model)</td>
<td>6.92*</td>
<td>9.83**</td>
<td>4.06</td>
<td>6.21*</td>
<td>8.19*</td>
<td>8.46*</td>
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</tr>
</tbody>
</table>

n = 494 firm-year observations. Standard errors in parentheses.
† p < .10, * p < .05; ** p < .01; *** p < .001
<table>
<thead>
<tr>
<th></th>
<th>Performance Relative to Social Aspirations</th>
<th>Performance Relative to Historical Aspirations</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Abandon Strategy</td>
<td>Supplement Strategy</td>
</tr>
<tr>
<td>Intercept</td>
<td>-8.13***</td>
<td>-4.12***</td>
</tr>
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<td></td>
<td>(1.45)</td>
<td>(1.15)</td>
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<tr>
<td>Number of models</td>
<td>0.08</td>
<td>0.40**</td>
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<td></td>
<td>(0.18)</td>
<td>(0.13)</td>
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<tr>
<td>Log of firm sales</td>
<td>0.27*</td>
<td>-0.00</td>
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<tr>
<td></td>
<td>(0.12)</td>
<td>(0.12)</td>
</tr>
<tr>
<td>Industry density</td>
<td>0.02**</td>
<td>0.00</td>
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<tr>
<td></td>
<td>(0.01)</td>
<td>(0.01)</td>
</tr>
<tr>
<td>Probability of failure</td>
<td>6.41</td>
<td>-13.16†</td>
</tr>
<tr>
<td></td>
<td>(4.75)</td>
<td>(7.43)</td>
</tr>
</tbody>
</table>

**SOCIAL ASPIRATIONS**

Perf. < social aspirations | 0.57 | 1.11* |
|                          | (0.57) | (0.56) |

Perf. > social aspirations | 0.05 | 1.02*** |
|                          | (0.35) | (0.28) |

**HISTORICAL ASPIRATIONS**

Perf. < hist. aspirations | 1.70* | 1.59 |
|                          | (0.87) | (1.09) |

Perf. > hist. aspirations | 0.18 | 0.86*** |
|                          | (0.32) | (0.26) |

Likelihood Ratio $\chi^2$ 297.66*** 297.67***

$n = 494$ firm-year observations. Standard errors in parentheses.
† $p < .10$, * $p < .05$; ** $p < .01$; *** $p < .001$
FIGURE 1.
Summary of Proposed Relationships

Performance below aspirations → H1: (+) Problem-induced change → Likelihood of strategic change in response to punctuating event

Performance above aspirations → H2: (+) Opportunity framing → Likelihood of strategic change in response to punctuating event

H3a: Abandon prior strategy
H3b: Supplement prior strategy

FIGURE 2.
Failure induced change/aspirations predictions: H1 and H2

Likelihood of Response

Performance Relative to Aspirations
FIGURE 3.
Effect of Performance Relative to Aspirations on Response Likelihood*

*Incumbent firms only. Lines plotted only over range two standard deviations beyond the mean performance relative to aspirations.
REFERENCES


