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Less Likely to Fail: Low Performance, Firm Size, and Factory Expansion in the Shipbuilding Industry

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The behavioral theory of the firm and prospect theory predict that performance below an aspiration level increases risk taking, but researchers also propose that performance below an aspiration level decreases risk taking. These conflicting predictions primarily hinge on whether decision makers perceive negative performance as a repairable gap or as a threat to firm survival. This study examines a boundary condition of these conflicting predictions. We argue that a firm's resource endowment affects decision makers' risk tolerance: Managers in firms with large stocks of resources are buffered from the threat of failure and conform to the prediction of greater risk taking in response to performance decreases; managers in firms with limited resources view low performance as a step closer to failure and decrease risk taking in response to performance decreases. Using data on the risky decision of factory expansion in shipbuilding firms and firm size as an indicator of the stock of tangible resources, we find that performance below the aspiration level reduces risk taking in small firms, but either does not affect risk taking or increases risk taking in large firms. These findings are largely consistent with our predictions and also suggest that large firms are more inert than small firms.

Key words: organizations; organizational decision making; risk taking
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Introduction

The behavioral perspective has guided much recent research on risky organizational changes. Its central argument is that decision makers use an aspiration level to evaluate performance and that the performance relative to the aspiration level influences their inclination to take risks and make changes (Cyert and March 1963; March and Shapira 1987, 1992; Shapira 1986). The theory is based on psychological processes of risk perception and preference (Kahneman and Tversky 1979) and organizational processes of search (Cyert and March 1963).

Most studies adopting this theoretical perspective suggest that, when performance is above the aspiration level, increases in performance decrease risk taking (Bromiley et al. 2001, Nickel and Rodriguez 2002). In contrast, the effect of changes in performance when performance falls below the aspiration level remains subject to active debate (March and Shapira 1987, 1992; Mone et al. 1998; Ocasio 1995; Sitkin and Pablo 1992). Researchers have focused on two opposing arguments. One proposes that performance below the aspiration level heightens awareness of needs for improvement and stimulates risk taking (Cyert and March 1963, Kahneman and Tversky 1979), whereas the other suggests that performance below the aspiration level heightens awareness of danger and leads to risk aversion (Lopes 1987, Sitkin and Pablo 1992, Staw et al. 1981).

Although the debate regarding the conflicting predictions of risk seeking and risk aversion has received considerable attention (March and Shapira 1987, 1992; Mone et al. 1998; Ocasio 1995), it rests on limited empirical evidence. Evidence of risk aversion when performance is below the aspiration level comes primarily from studies of risk behavior in response to organizational decline (e.g., Greenhalgh 1983, Cameron et al. 1987), manifested as a reduction in financial resources. Because those studies focus on organizations close to failure, it remains unclear whether decision makers experiencing low but not near-fatal performance would also show risk aversion. Except for two studies that provide some suggestive evidence (Miller and Bromiley 1990, Wiseman and Bromiley 1996), prior research does not show risk aversion when performance is below the aspiration level.

Evidence of risk seeking when performance is below the aspiration level is also relatively rare. Most studies of organizational risk taking examine the effect of performance on risk behavior, but assume that this relationship is the same when performance is both above and below the aspiration level (Bromiley 1991, Singh 1986, Wiseman and Catanach 1997). Therefore, the researchers estimate the effect of performance on risk behavior as an average across the performance range. Some studies have separated the performance above and below aspiration levels and have shown risk taking when performance is below the aspiration level (Gooding et al. 1996, Greve 1998, Ketchen and Palmer 1999, Miller and Chen 2004).

This study attempts to clarify the effect of performance on risk behavior by identifying organizational conditions under which performance below the aspiration level leads to risk taking or risk aversion. Building on the shifting-focus model of risk taking (March and Shapira 1987, 1992), we propose that a firm's stock of resources affects risk behavior. Low performance can threaten the normal functioning of a firm and even its survival, but these consequences are likely to be contingent on a firm's resource endowment (Levinthal 1991). Levels of low performance that do not normally threaten firms with large stocks of resources can induce the failure of firms with limited resources. We expect that managers of firms with a limited stock of resources perceive the low performance as a step closer to firm failure. Threatened by the prospect of additional losses that can jeopardize the survival of the firm, these decision makers become risk averse. Their risk behavior presumably stems from a combination of their inability to generate risky courses of action (Staw et al. 1981) and their choice of low-risk options that do not require investing the firm's few remaining resources (March and Shapira 1992). In contrast, managers of firms with large stocks of resources are less concerned about the risk of incurring additional losses, because additional losses would not threaten the firm's survival. They look more at the upside of decisions that require substantial allocations of resources, and are more prone to make risky decisions.

We explore these ideas by examining the risk behavior of small and large firms when performance is below the aspiration level. Firm size is a primary indicator of tangible resources and has been shown to reduce firm failure rates (Brüderl and Schüssler 1990, Dobrev 2001, Levinthal 1991, Mitchell 1994). The specific risk behavior we analyze is factory expansion by Japanese shipbuilders. Factory expansion is a risky decision because the consequences are uncertain and may include losses (March and Shapira 1987, Palmer and Wiseman 1999, Ruefli et al. 1999). By upgrading production assets or adding employees, a firm can overcome productivity gaps or capacity constraints, but additional investments can worsen the situation if the implementation of the expansion is not successful or if environmental changes depress the market served by the factory. In shipbuilding, factories are important strategic assets that are risky because of high fluctuations in demand. Having had 30% of the global market in recent years, the Japanese shipbuilding industry is an important subpopulation of firms within a single national context.

Theory and Hypotheses

The Effect of Performance Below the Aspiration Level on Risk Taking

Research on organizational risk taking has been guided primarily by two theories: the behavioral theory of the firm (Cyert and March 1963), in particular the component regarding the search process, and prospect theory (Kahneman and Tversky 1979). Researchers have emphasized the similarities between these two theories, noting that both theories predict risk aversion when performance is above an aspiration level and risk seeking when performance is below an aspiration level, and that both theories base their predictions on the following three components (e.g., Singh 1986, Lant and Montgomery 1987, Bromiley 1991). First, the decision maker focuses attention on an aspiration level for performance. In prospect theory, this aspiration level is the status quo, or a value of zero, whereas in the behavioral theory of the firm, the aspiration level is determined by social or historical comparison. Second, the decision maker uses this aspiration level to code outcomes as failures when performance is below it and as successes when performance exceeds it. Third, the desire to overcome a performance failure is stronger than the desire to extend success, so decision makers below the aspiration level accept more risks than decision makers above the aspiration level.

Although risk aversion when performance is above the aspiration level is widely accepted, the claim of risk seeking when performance is below the aspiration level has been controversial (Lopes 1987; March and Shapira 1987, 1992; Ocasio 1995; Sitkin and Pablo 1992). Researchers have proposed two related arguments for why performance below the aspiration level might lead to risk aversion rather than to risk seeking. Drawing primarily from research that developed the threat-rigidity hypothesis (Staw et al. 1981), the first argument holds that decision makers interpret performance below the aspiration level not as a repairable gap, as prospect theory and the behavioral theory of the firm assume, but rather as a threat to their vital interests (Milliken and Lant 1991, Sitkin and

Pablo 1992, Ocasio 1995, Mone et al. 1998). Perceptions of threat lead to psychological stress and anxiety, which restricts information processing and reduces behavioral flexibility. Finally, an inability to generate and consider risky alternatives makes decision makers rigid and risk averse.

The second argument proposes that risk aversion results from decision makers' motivational predispositions (Lopes 1987). In this view, most decision makers have a strong need for security and are motivated to avoid bad outcomes. When performance is below the aspiration level, they experience a conflict between the desire to improve the performance by making risky decisions and the desire to preserve a position of safety by avoiding additional losses. This conflict gives rise to unstable risk preferences and to a greater frequency of low-risk choices than hypothesized by prospect theory and the behavioral theory of the firm. These two arguments emphasize different processes underlying risk aversion—an inability to generate risky alternatives and a desire to preserve a position of safety. However, both arguments imply that interpretation of low performance as a threat induces risk aversion.

In spite of the continued attention given to these conflicting predictions, we found just six studies that showed that performance below the aspiration level affected firms' risk behavior, and these studies offer contradictory evidence. Gooding et al. (1996) found that firms with performance in the lowest quintile took more risks in response to performance declines. Greve (1998) found that decreases in performance increased the risk taking of firms both above and below the aspiration level, but had a weaker effect on those below the aspiration level. Ketchen and Palmer (1999) found that low performance increased organizational risk taking. Miller and Chen (2004) found that decreases in performance increased organizational risk taking in all (low, medium, and high) ranges of performance. Miller and Bromiley (1990) found that deterioration in performance increased risk taking for high performers but decreased it for low performers. Wiseman and Bromiley (1996) found that lower performance caused less risk taking in a sample of declining firms. Thus, the first four studies suggest risk seeking below the aspiration level, whereas the latter two studies provide evidence of risk aversion below the aspiration level.[1] In both these latter studies, the evidence in favor of risk aversion was counter to the authors' predictions and led to calls for more research.

To help resolve this longstanding debate and to correct the imbalance between theoretical and empirical work, we begin by testing the two competing predictions regarding the effect of performance below the aspiration level on firms' risk behavior. The first is proposed by the behavioral theory of the firm and prospect theory; the second is the risk-aversion hypothesis.

Hypothesis 1. *When performance is below the aspiration level, performance decreases lead to more risk taking.*

Hypothesis 2. *When performance is below the aspiration level, performance decreases lead to less risk taking.*

The Shifting-Focus Model of Risk Taking and the Moderating Effect of Firm Size

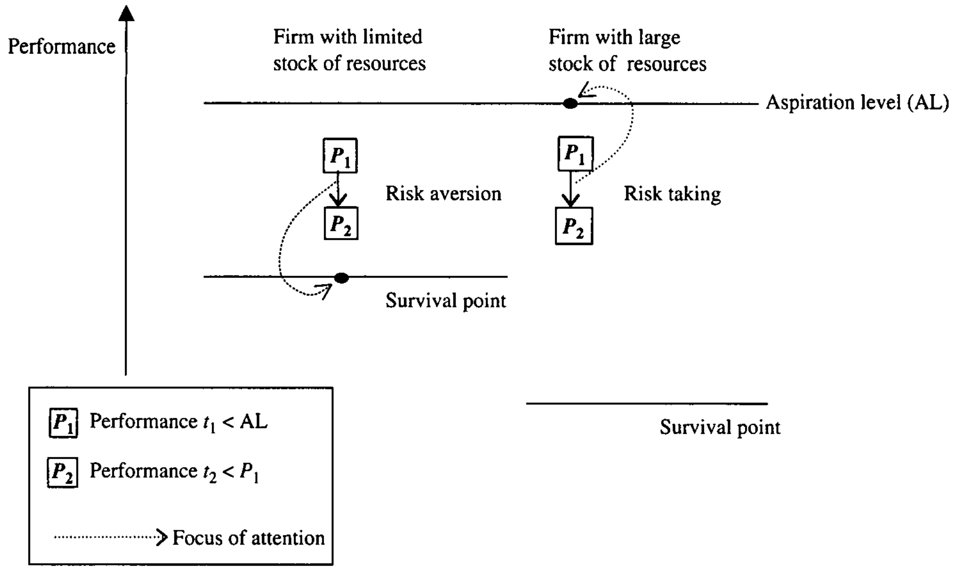
Researchers have suggested that the conflicting findings regarding risk seeking under conditions of adversity may be due to unobserved heterogeneity and have proposed numerous contingencies that may explain when risk aversion or risk seeking prevails (Mone et al. 1998, Ocasio 1995, Sitkin and Pablo 1992). However, few studies have addressed this issue empirically (but see Chattopadhyay et al. 2001). March and Shapira (1987, 1992) have made an important contribution to this literature by proposing the shifting-focus model of risk taking. Drawing on extensive studies of how managers perceive risk (Shapira 1986), they noted that decision makers do not direct their attention to a single reference point, as prospect theory and the behavioral theory of the firm assume. Rather, decision makers switch their focus between the aspiration level for performance and the survival point—the point at which performance is so low that the organization fails. March and Shapira (1992) suggested that the reference point on which decision makers focus is important because it affects how they interpret performance outcomes, and these interpretations in turn influence whether decision makers respond to changes in performance by increasing or decreasing risk taking.

The shifting-focus model of risk taking reconciles the conflicting predictions of risk aversion and risk seeking by suggesting two scenarios for firms with performance above the survival point but below the aspiration level.[2] In the first scenario, decision makers focus on the survival point, which makes them interpret decreases in performance as a step closer to failure and as a serious threat. This interpretation of low performance induces risk aversion either because perceptions of threat make decision makers rigid and

[1] Additional evidence comes from two individual-level experimental (Laughhunn et al. 1980) and survey (Shapira 1986) studies finding that very low performance reduced risk taking. There has also been work finding no effect on firm risk taking below the aspiration level (e.g., Greve 2003a).

[2] Because decision makers aspire to do better than firm failure, the aspiration level is always higher than the survival point. Also, performance below the survival point leads to failure, so we can restrict our attention to performance below the aspiration level and above the survival point.

Figure 1 The Effect of a Firm's Resource Endowment on Risk Taking Below the Aspiration Level



unable to generate risky courses of action, or because decision makers deliberately opt for low-risk options that reduce the probability of a firm's demise. Thus, as performance approaches the survival point, risk taking decreases. In the second scenario, decision makers focus on the aspiration level. As a result, they interpret decreases in performance as repairable gaps and take greater risks the further the performance falls below the aspiration level. The important implication, then, is that performance decreases below the aspiration level lead to increased risk taking if the focus is on the aspiration level, but lead to decreased risk taking if the focus is on the survival point.

Managers may shift attention between these reference points according to various rules (March and Shapira 1992). We propose a rule that depends on two factors. First, decision makers focus on the reference point that is closer to actual performance because the consequences of reaching the closer point loom larger. Second, a firm's stock of resources influences the position of the survival point, both cognitively and in reality. Extensive financial assets, manufacturing infrastructures, and a large workforce allow firms to endure many periods of poor financial performance with little threat of failure (Levinthal 1991). This buffering effect of a large stock of resources lowers the performance level at which the organization's survival is in danger (i.e., the survival point). Small resource endowments, in contrast, raise the level of a firm's survival point.

Figure 1 graphically represents the different positions of the survival point for a firm with a limited stock of resources and a firm with a large stock of resources and shows their implications for risk behavior. When performance falls below the aspiration level, the greater distance between the survival point and the aspiration level makes managers of firms with large stocks of resources focus on the aspiration level, whereas managers of firms with small stocks of resources focus on the more proximate survival point. As a result, managers of resource-rich firms interpret low performance as a gap that can be closed by taking risks, whereas managers of resource-poor firms interpret low performance as a step closer to a serious crisis that calls for risk aversion.

Empirical evidence that a small stock of resources makes firms more vulnerable comes from research showing that small firm size increases the probability of firm failure (Brüderl and Schüssler 1990, Dobrev 2001, Mitchell 1994). These studies explicitly refer to firm size as an indicator of a firm's current resource endowment. Mitchell (1994, p. 577), for example, suggests that "larger businesses tend to have larger pools of financial and managerial resources that help overcome problems that threaten their survival." Large firm size also increases the potential to attract additional resources. As Brüderl and Schüssler (1990, p. 535) note: "large firms have advantages in raising capital, face better tax conditions and government regulations, and are in better position to compete for qualified labor."[3] Accordingly, we use firm size as an

[3] The definition of small depends on the production technology of the industry. For example, Naikai shipbuilding, with 589 employees, is just large enough to build long-range vessels for the international shipbuilding market. As is common for small shipbuilders, much of its business is repairs and change instead of the more lucrative newbuild contracts. For example, in 1993 its newbuild tonnage was 63,479 while its repair/change tonnage was 824,664. For comparison, a Suezmax oil tanker (small enough to go through the Suez channel) is 150,000 dead-weight tons Suezmax and larger ships require the facilities found in large shipyards. In other industries, a firm with 589 employees may fall in the medium or large categories.

indicator of a firm's resource endowment and propose that it modifies the effect of low performance on risk behavior as follows:

HYPOTHESIS 3. *When performance is below the aspiration level, performance decreases lead to less risk taking among small firms and more risk taking among large firms.*

Firm Size and Inertia

We have proposed that firm size affects the performance-risk relationship when performance is below the aspiration level, but firm size can also influence risk taking irrespective of the level of performance. The theory of structural inertia holds that large firms are encumbered by structural constraints such as slow communication channels, the need for multiple approvals, and norms and procedures that limit decision makers' ability to make organizational changes (Hannan and Freeman 1984). An implication of this theory is that the structural constraints associated with large firm size can discourage the pursuit of risky courses of action. Thus, inertia theory predicts the following:

HYPOTHESIS 4. *Firm size decreases risk taking.*

Data and Methods

Most research on organizational risk taking examines either aggregate measures of firm risk (e.g., Gooding et al. 1996, Palmer and Wiseman 1999) or specific risky decisions (e.g., McNamara and Bromiley 1997). The advantage of focusing on specific decisions is that they more directly correspond to the actual risk behavior of managers (March and Shapira 1987). Taking this latter approach, we examine the strategic decisions regarding factory expansion made by Japanese shipbuilders.

We use data for shipbuilders on the primary list of the Tokyo and Osaka Stock exchanges from 1974 to 1995. The firm data come from the Nikkei annual directory of corporations, and industry data were taken from the Ministry of Transportation's annual report on shipbuilding. Nine Japanese shipbuilders were listed in the stock market throughout the sample period, and two exited the data through failure (Hashimama) and stock delisting (Hakodate), respectively. We use all years in which complete data are available for these 11 firms, for a total of 178 firm-years.[4]

[4] We also identified 12 other builders of large- and medium-sized ships in Japan that were not listed in the stock market, of which two failed during the study period, but we were unable to obtain accounting data for these firms. Many of these firms appear to be family controlled. In addition to these builders of medium and large ships, there are numerous builders of small ships. Their plants and production processes are sufficiently different from these builders that they should be considered a distinct organizational form.

Measures

Dependent Variables. We examined five variables indicating factory expansion. The first three are the logged ratio of the year-end and year-start of the firm's (1) value of the machinery, (2) value of the nonmachinery real assets, and (3) number of workers. All these are long-term investments that cannot easily be disposed of if they turn out not to be needed. The machinery and other real assets of shipbuilders are highly specialized and immobile, and the firms honored lifetime employment guarantees during the study period. The final two variables are counts of the number of additions or deletions of factory functions according to the categories: (1) new ships, (2) ship repairs, (3) engines, (4) accessories, (5) steel, and (6) unrelated business.

We first analyzed growth in the value of the machinery. Machinery can be purchased and installed quickly and is not autocorrelated across years, making it the most sensitive indicator of investment decisions. Next, we extracted a measure of overall expansion from the five variables by performing a principal factor analysis with varimax rotation. This yielded two significant factors: One factor captured factory expansion, and the other captured function change. The expansion factor (eigenvalue 0.746) had similar loadings for value of machinery (0.514) and nonmachinery (0.535) real assets and number of workers (0.403), and small loadings of the function add (0.115) and drop (0.136) variables. The other factor (eigenvalue 1.084) had high loadings for function add (0.722) and drop (0.711), and small loadings for the other three variables (−0.076, −0.126, and −0.183, respectively). The score of the expansion factor was used as the dependent variable in the analysis. Maximum-likelihood or iterated principal factor methods of constructing the expansion factor had correlations of 0.99 with our approach.

Firm Performance. We measured performance using the traditional accounting measures of returns: return on equity (ROE), return on assets (ROA), and return on sales (ROS). We display the first two of these for brevity and note that the ROS findings resembled the ROA findings, but had somewhat weaker effects. Performance measures are evaluated against aspiration levels, which may be determined by the recent history of performance of the organization (historical aspiration levels) or by the performance of similar others (social aspiration levels) (Cyert and March 1963). We generated historical aspiration levels by taking an exponentially weighted average of past values on the performance variable (Greve 1998, Lant 1992, Levinthal and March 1981). The formula we used to compute historical aspiration levels is:

$$A_t = aA_{t-1} + (1-a)P_{t-1}.$$

Here, A is aspiration level, P is the performance, t is a time subscript, and a is the weight given to the most recent aspiration level. The a can be found by estimating the models with different values of a and finding which value best fits the data. We used such preliminary analysis to establish that ROE had an a of 0.1, ROA had 0.3, and ROS had 0.2. These low as suggest fairly rapid updating of the aspiration level, as one would expect if decision makers believe that their industry is highly dynamic, so that only recent performance data are valid indicators of future prospects. We took the average performance of other firms in the same year as the social aspiration level (Lant and Hurley 1999, Mezias et al. 2002).

To examine whether the effect of performance on factory expansion differs according to whether the performance is above or below the aspiration level, we split the performance variables into two categories. *Performance above the aspiration level* equals 0 when performance is below the aspiration level and equals performance minus the aspiration level when performance is above the aspiration level. Similarly, *performance below the aspiration level* equals 0 when performance is above the aspiration level and equals performance minus the aspiration level when performance is below the aspiration level.

Firm Size. For firm size, we used the logged number of employees, which is a good measure of overall firm size in a given industry. In these data, the logged number of employees correlates highly with another standard size measure, the accounting value of assets. We logged the number of employees because we think that this specification better captures the effect of size on risk taking. It means that a given percentage increase has the same effect regardless of firm size, whereas a linear measure would mean that a given number of workers added has the same effect regardless of firm size. Going from 600 to 1,200 workers ought to affect risk taking more than going from 50,000 to 50,600 workers. The logging gives the size variable an approximately normal distribution.

To examine the interaction between firm performance and firm size, we normalized firm size between 0 and 1 using the lowest and highest values in the data. Thus, the largest firm (Mitsubishi, with 78,104 employees) had a score of 1, and the smallest (Naikai, with 538 employees) had a value of 0. This simplifies the interpretation of the coefficients in Tables 2 and 3 for the minimum and maximum values in the data. The effect for the smallest firm in the data is the main effect of firm performance, and the effect for the largest firm in the data is the sum of the main effect of firm performance and the interaction effect between firm performance and firm size. The effects for all other firms fall in between. Firm size is time varying, as all variables are, but the scaling function is time constant. Our approach is mathematically equivalent to the alternative approach of taking the interactions as deviations from the mean, but is easier to interpret when testing hypotheses that contrast the extremes in the size distribution.

Control Variables. Control variables were entered to describe firm and factory characteristics and the economic conditions in the previous year. Including *firm age* controlled for processes of bureaucratization and obsolescence associated with the passage of time. The firm's *product diversification* was entered by computing the entropy index of product line shares given in the Nikkei directory. *Operating cash flow* measured the ability to fund investments without borrowing, and allowed us to control for an alternative explanation of differences in the risk behavior of small

Table 1 Descriptive Statistics and Correlations

Variable	Mean	Std. dev.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1. Log machinery	9.33	1.472	1.0															
2. Firm expansion	0.063	0.599	−0.03	1.0														
3. Firm age	86.00	17.893	0.29	−0.21	1.0													
4. Diversification	1.08	0.637	0.85	−0.17	0.46	1.0												
5. Operational cash flow	0.015	0.051	0.28	−0.13	0.24	0.23	1.0											
6. Order reserve	0.8563	1.022	0.83	−0.05	0.44	0.62	0.37	1.0										
7. Oil shock	0.224	0.418	0.02	0.32	−0.31	−0.18	−0.25	−0.09	1.0									
8. Ship production	9.421	2.950	0.03	0.33	−0.26	−0.18	−0.25	−0.05	0.85	1.0								
9. Firm size	0.338	0.269	0.92	−0.06	0.34	0.77	0.19	0.84	0.13	0.13	1.0							
10. ROE > hist. asp.	0.074	0.157	−0.16	−0.12	−0.22	−0.16	−0.04	−0.16	0.00	−0.06	−0.19	1.0						
11. ROE < hist. asp.	−0.086	0.146	0.27	0.08	0.15	0.26	−0.12	0.25	0.07	0.11	0.27	0.28	1.0					
12. ROE > soc. asp.	0.113	0.238	−0.10	0.08	−0.17	−0.17	0.08	−0.08	−0.04	−0.01	−0.12	0.13	−0.06	1.0				
13. ROE < soc. asp.	−0.120	0.541	0.17	0.04	−0.03	0.17	0.02	0.09	0.03	0.02	0.12	−0.07	0.00	0.10	1.0			
14. ROA > hist. asp.	0.008	0.015	−0.20	−0.05	−0.08	−0.12	−0.05	−0.15	−0.08	−0.13	−0.22	0.67	0.32	0.05	−0.05	1.0		
15. ROA < hist. asp.	−0.009	0.017	0.26	0.12	0.09	0.18	−0.08	0.23	0.16	0.20	0.24	0.21	0.81	−0.01	0.02	0.30	1.0	
16. ROA > soc. asp.	0.009	0.014	−0.00	−0.05	−0.01	−0.05	0.13	0.01	−0.16	−0.15	−0.00	−0.00	0.08	0.37	0.13	0.05	0.13	1.0
17. ROA < soc. asp.	−0.008	0.014	0.15	0.04	0.06	0.06	−0.08	0.14	0.11	0.11	0.21	0.09	0.32	0.22	0.30	0.05	0.42	0.37

Notes. $N = 178$; correlation coefficients ≥ 0.16 are significant at the < 0.05 level.

and large firms. Small firms that experience low performance may face greater liquidity constraints than similarly performing larger firms, and this difference, in turn, may be the source of differences in risk behavior. This variable equals the net profits plus depreciation, change in accruals, and change in accounts receivable, minus the change in accounts payable and inventories. The firm's end-of-year *order reserve* represents nearly certain future income, so a high reserve reduces the risk of factory expansion.

We also controlled for important factors in the industry environment. To take the effect of the 1973 *oil shock* into account, an indicator variable was set to 1 for the years 1974–1976. *Ship production* is the annual tonnage (scale: million G/T) finished by the Japanese shipbuilders.

Models

For machinery growth we estimated models of size-dependent growth with fixed effects for each firm (Barron et al. 1995). Size-dependent growth models are a generalization of Gibrat's law, in which the common pattern of growth rates that are less than proportional to the size will give a coefficient estimate of less than unity for the lagged dependent variable. We used a likelihood ratio test to determine that fixed effects were needed to control for significant firm differences in machinery growth rates.

For the overall expansion model we employed generalized estimating equations (GEE), which generalize quasi likelihood to the panel context (Liang and Zeger 1986). This method allows specification of various forms of within-group correlation, and its standard errors are robust to misspecification of the error term. A likelihood ratio test showed that fixed effects for each firm were not significant, but the exchangeable error structure (similar to random effects) provided a good fit to the data and controls for firm differences in growth rates. For this analysis we use robust estimates of the standard errors.

Results

Table 2 reports the results of the machinery growth analyses. For each variable ROE and ROA we show models with historical and social aspiration levels, and each of these is shown with and without the size interactions that test Hypothesis 3. Tests of significance in the table are two tailed, except those concerning Hypotheses 3 and 4, which are one tailed because the predictions are unidirectional. Table 3 reports the results of the overall expansion analysis.

Table 2 Fixed-Effects Models of Firm Growth of Factory Machinery

	ROE				ROA			
	Historical		Social		Historical		Social	
	1	2	3	4	5	6	7	8
Log machinery $t-1$	0.452^{**}	0.461^{**}	0.563^{**}	0.558^{**}	0.421^{**}	0.417^{**}	0.450^{**}	0.449^{**}
	(0.067)	(0.066)	(0.059)	(0.059)	(0.061)	(0.061)	(0.065)	(0.065)
Firm age	0.006	0.009	0.003	0.003	0.007	0.009	0.008	0.008
	(0.008)	(0.008)	(0.006)	(0.006)	(0.007)	(0.007)	(0.007)	(0.007)
Diversification	0.085	0.155	0.016	−0.016	0.102	0.170	0.158	0.133
	(0.232)	(0.225)	(0.194)	(0.195)	(0.222)	(0.223)	(0.227)	(0.231)
Operational cash flow	0.534	0.008	0.163	−0.007	0.466	0.188	0.382	0.444
	(0.516)	(0.528)	(0.425)	(0.438)	(0.488)	(0.514)	(0.492)	(0.496)
Order reserve	0.265^{**}	0.312^{**}	0.246^{**}	0.254^{**}	0.278^{**}	0.309^{**}	0.295^{**}	0.289^{**}
	(0.095)	(0.092)	(0.079)	(0.079)	(0.090)	(0.090)	(0.091)	(0.092)
Oil shock	0.161	0.187	0.136	0.121	0.180	0.205	0.181	0.179
	(0.132)	(0.128)	(0.111)	(0.113)	(0.126)	(0.125)	(0.127)	(0.131)
Ship production	0.017	0.018	0.016	0.016	0.016	0.016	0.019	0.020
	(0.017)	(0.017)	(0.014)	(0.014)	(0.017)	(0.017)	(0.017)	(0.017)
Firm size	0.757	0.532	0.381	0.344	0.761	0.696	0.824	0.861
	(0.620)	(0.607)	(0.517)	(0.519)	(0.584)	(0.588)	(0.583)	(0.591)
Performance – aspiration	−0.197	-0.409^{*}	−0.040	−0.170	$-2.906^{\dagger}$	$-4.244^{\dagger}$	1.069	0.942
(above aspiration)	(0.151)	(0.189)	(0.085)	(0.124)	(1.676)	(2.274)	(1.809)	(1.963)
Performance – aspiration	0.242	0.744^{**}	0.000	0.023	1.818	3.989^{*}	1.340	1.507
(below aspiration)	(0.177)	(0.220)	(0.036)	(0.046)	(1.525)	(1.813)	(1.410)	(1.422)
Performance – aspiration		1.565		0.479		9.996		4.388
× firm size (above asp.)		(0.972)		(0.316)		(9.702)		(5.624)
Performance – aspiration		-3.414^{**}		−0.452		-18.797^{*}		−3.386
× firm size (below asp.)		(0.942)		(0.612)		(8.678)		(3.399)
F test of f.e.	2.60^{**}	2.91^{**}	2.66^{**}	2.83^{**}	2.83^{**}	2.80^{**}	2.57^{**}	2.63^{**}

${}^{\dagger}p < 0.10$; ${}^{*}p < 0.05$; ${}^{**}p < 0.01$. Standard errors are in parentheses.

Table 3 GEE Models of Firm Expansion of Factories

	ROE				ROA			
	Historical		Social		Historical		Social	
	1	2	3	4	5	6	7	8
Firm age	−0.004**	−0.004**	−0.005**	−0.006**	−0.003**	−0.003**	−0.004**	−0.004**
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Diversification	0.045	0.062	0.145**	0.139**	0.133*	0.161**	0.174*	0.177*
	(0.037)	(0.045)	(0.043)	(0.049)	(0.064)	(0.057)	(0.078)	(0.078)
Operational cash flow	−0.099	−0.722	−1.165	−1.410	−0.869	−1.233	−0.923	−0.918
	(0.461)	(0.633)	(0.903)	(0.956)	(0.771)	(0.947)	(0.766)	(0.774)
Order reserve	0.155**	0.193**	0.214**	0.235**	0.195**	0.212**	0.230**	0.225**
	(0.041)	(0.054)	(0.048)	(0.050)	(0.054)	(0.061)	(0.060)	(0.058)
Oil shock	0.413†	0.392†	0.365†	0.361†	0.335	0.322	0.324	0.295
	(0.215)	(0.222)	(0.210)	(0.207)	(0.234)	(0.240)	(0.242)	(0.263)
Ship production	0.027	0.033	0.040	0.041	0.035	0.041	0.043	0.048
	(0.026)	(0.027)	(0.028)	(0.029)	(0.033)	(0.034)	(0.030)	(0.033)
Firm size	−0.841**	−1.009**	−0.976**	−1.005**	−0.989**	−1.002**	−1.171**	−1.173**
	(0.195)	(0.251)	(0.223)	(0.254)	(0.277)	(0.298)	(0.363)	(0.385)
Performance − aspiration (above aspiration)	−0.655†	−0.330	0.296	0.118	−2.600	1.129	0.215	−0.660
	(0.335)	(0.419)	(0.220)	(0.328)	(3.348)	(3.632)	(1.450)	(1.935)
Performance − aspiration (below aspiration)	0.938**	1.295**	−0.004	−0.053	3.120*	4.216**	4.193†	4.198
	(0.345)	(0.450)	(0.023)	(0.049)	(1.339)	(0.699)	(2.530)	(2.706)
Performance − aspiration × firm size (above asp.)		−2.353*		0.511		−23.359*		4.970
		(1.165)		(0.592)		(9.600)		(4.955)
Performance − aspiration × firm size (below asp.)		−2.566*		0.961		−10.462†		0.571
		(1.069)		(0.655)		(6.676)		(3.142)
Constant	0.339	0.297	−0.003	0.099	0.029	−0.057	−0.019	−0.037
	(0.252)	(0.257)	(0.265)	(0.234)	(0.396)	(0.401)	(0.360)	(0.360)

†$p < 0.10$; *$p < 0.05$; **$p < 0.01$. Robust standard errors are in parentheses.

Machinery Growth

Return on Equity. Model 1 shows that the ROE adjusted by the historical aspiration level has a nonsignificant effect on the growth of machinery above and below the aspiration level. Model 2 adds the interaction with firm size. Recall that the main effect equals the effect on the smallest firm in the sample, and the main effect plus the interaction equals the effect on the largest firm in the sample. The effects on the other firms are in-between. The estimates show that the nonsignificant effect of ROE below the aspiration level in Model 1 is in fact a result of blending two opposite effects for firms of different size. ROE has a positive and significant estimate consistent with risk aversion in small firms, and the interaction of ROE and firm size has a negative and significant estimate consistent with less risk aversion in large firms. In this and all subsequent models with interactions, we test whether the sum of the main effect and the interaction is significantly different from 0 with a Wald test (χ^2, one degree of freedom). The sum of the coefficients is negative and significantly different from 0 ($p < 0.01$), showing that large firms increase risk taking as ROE declines. These results are fully consistent with Hypothesis 3. The main effect of firm size is not significant, so Hypothesis 4 is not supported. The lagged machinery value has a coefficient significantly below unity, however, which suggests inertia in large firms.

The analysis of the social aspiration level for ROE shows no significant effect on machinery expansion. This pattern is also repeated in the analysis for ROA adjusted by the social aspiration level, and in the next table we likewise see no effect of performance relative to the social aspiration level on overall factory expansion. This difference in the results for the social and historical aspiration levels suggests that managers make factory expansion decisions with attention to an internal rather than an external standard for performance. It has been suggested that managers prefer social aspiration levels when they see the firm as comparable to others, but prefer historical aspiration levels when they view the firm as unique (Greve 2003b), which would imply that managers of shipbuilding view their firm as distinct from other shipbuilders when making factory expansion decisions. Although this is a heuristic judgment that may be biased, it has some basis in reality because of the high heterogeneity of firm (and even plant) production assets in the shipbuilding industry. Strong effects of social aspiration levels have been found in the comparatively homogeneous radio-broadcasting industry (Greve 1998).

Return on Assets. Models 5 and 6 show the same patterns for ROA that were seen in the models for ROE. There is a marginally significant negative effect of ROA above the aspiration level and a nonsignificant effect of ROA below the aspiration level when only the main effects are added, but the interactions with size reveal distinct reactions to low performance for small and large firms. Small firms reduce risk taking when performance declines, as seen in the positive and significant effect of ROA below the aspiration level. Large firms increase risk taking, as seen in the large and negative effect of the firm-size interaction with ROA below the aspiration level. The difference is significant ($p < 0.05$), and the results are fully supportive of Hypothesis 3.

Factory Expansion

Table 3 estimates models with the same independent variables, but with overall factory expansion as the dependent variable. The results are consistent with those of the machinery analysis.

Return on Equity. Model 1 shows that ROE adjusted by the historical aspiration level has a negative effect on factory expansion above the aspiration level and a positive effect below. Model 1 thus supports Hypothesis 2, that performance decreases below the aspiration level lead to less risk taking and contradicts Hypothesis 1, that performance decreases below the aspiration level lead to more risk taking, as prospect theory and the behavioral theory of the firm predict.

Model 1 also shows a negative and highly significant effect of firm size on factory expansion, in support of Hypothesis 4, that large firms are more inert. This finding is reproduced in all subsequent models, but to avoid repetition we only report it here.

Model 2 adds the interactions with firm size. For small firms, ROE has a negative and nonsignificant effect on factory expansion above the aspiration level and a highly significant, positive effect below the aspiration level. This shows threat rigidity below the aspiration level for small firms. Both interaction variables are significant and have negative signs. For the largest firm in the sample, ROE has a negative and significant effect on factory expansion above the aspiration level ($p < 0.01$) and below the aspiration level ($p < 0.05$). The findings support Hypothesis 3's prediction of less risk taking for small firms and more risk taking for large firms below the aspiration level.

Return on Assets. Model 3 shows the effect of ROA adjusted by the historical aspiration level without interactions with the firm size. ROA has a negative but nonsignificant effect on factory expansion above the aspiration level and a positive and significant effect below. This supports Hypothesis 2 and contradicts Hypothesis 1. Model 6 adds the interactions with firm size. For small firms, ROA has a positive and significant effect on factory expansion below the aspiration level and a negative but nonsignificant effect above the aspiration level, as before. Both interaction variables are negative, and are significant for performance above the aspiration level and marginally significant for performance below the aspiration level. The largest firm in the sample shows a negative and significant relation between ROA and factory expansion above the aspiration level ($p < 0.01$) and a negative but nonsignificant relation below the aspiration level ($p = 0.18$). Thus, the ROA models partly support Hypothesis 3: Below the aspiration level, performance decreases lead to less risk taking among small firms, but do not appear to affect the risk taking of large firms.

The findings from the machinery growth models and the factory expansion models are consistent with each other. We find that the response to performance relative to the historical aspiration level differs in large and small firms, with small firms showing a threat-rigidity pattern, while large firms were either unresponsive or showed greater risk taking as performance declined. Thus, firm size is a boundary condition for whether threat rigidity or prospect theory/behavioral theory of the firm findings should be expected, as predicted in Hypothesis 3.

These findings are most easily explained by a difference in risk taking caused by the greater threat implied by low performance for small firms. That is, faced with the same low performance, managers of small firms will perceive a higher threat and will avoid risky factory expansion. In order to check this interpretation of the findings, we performed an additional analysis. If small firms face a greater threat of failure when expanding too much, then the same level of firm expansion should put more financial stress on small firms than on large. We tested this proposition and found that plant expansion stresses shipbuilder finances in ways consistent with our reasoning. Expansion significantly increased the proportion of sales-generated cash used to cover interest on debts for small firms, but not for large firms. Likewise, current liabilities and total debts were significantly increased for small firms, but not for large firms. These results are available from the authors.

Conclusion

This study examined the effect of performance below the aspiration level on organizational risk taking. Our findings provide rare evidence in support of the hypothesis of risk aversion when performance is below the aspiration level. Models examining the effect of performance on factory expansion showed that decreases in performance below the aspiration level reduced risk taking (ROE and ROA models), contrary to the predictions of prospect theory

(Kahneman and Tversky 1979) and the behavioral theory of the firm (Cyert and March 1963), but consistent with the hypothesis of risk aversion (Lopes 1987, Staw et al. 1981).

We also showed that the finding that decreases in performance below the aspiration level will decrease risk taking masked differences between small and large firms. Small firms decreased risk taking in response to reduced firm performance. In contrast, large firms were either insensitive (ROA models) or increased risk taking (ROE models) in response to decreases in performance. These effects were found after controlling for operational cash flow, which suggests that differences in the risk behavior of small and large firms were not simply due to liquidity constraints.

The results support our argument that a firm's size affects decision makers' choice of the reference point and that this choice modifies risk behavior. Managers of small firms are more likely than managers of large firms to focus their attention on the survival point because small firms have limited resources and are vulnerable to levels of low performance that do not normally threaten large firms. A focus on the survival point induces managers of small firms to interpret a reduction in performance as a step closer to organizational failure, which invokes a risk-averse response, as the shifting-focus model of risk taking suggests, rather than as a repairable gap that can be closed by taking risks, as prospect theory and the behavioral theory of the firm predict. We also found that large firms took less risk at any given level of performance and showed some insensitivity to performance above the aspiration level. We interpret these findings as support for inertia theory's prediction that structural constraints encumber pursuit of risky courses of action in large firms.

Our approach of examining the interactive effect of size and performance on risk-taking behavior is novel and sheds light on previous studies of the effect of performance on risk taking. The shifting-focus model of risk elaborated in this paper suggests that differences in the risk behavior of small and large firms may lead to either a positive effect or a nonsignificant effect of low performance on risk, as the overall pattern of our results show. Recall that a positive effect means that decreases in performance below the aspiration level reduce risk taking. Earlier we reviewed four studies using direct measures of aggregate risk such as income stream uncertainty. One of these studies, Miller and Bromiley (1990), examined, as we do, the risk behavior of firms along the entire range of performance below the aspiration level, whereas the other three studies used subsamples of low-performing firms. Gooding et al. (1996) examined the bottom quintile of the performance distribution, Miller and Chen (2004) studied firms with values of Altman's (1984) bankruptcy score in the bottom 10%, and Wiseman and Bromiley (1996) selected firms with at least four years of declining sales out of a seven-year period. While Miller and Bromiley report, as we do, that low performance reduced risk taking, the other three studies report mixed results. Gooding et al. (1996) and Miller and Chen (2004) report increased risk taking after low performance, whereas Wiseman and Bromiley (1996) report the opposite effect. Thus, the study of risk that examines the entire range of low performance, as we do here, shows the same finding we do. The mixed results of studies that focus on subsamples of low-performing firms may be due to the manner in which low-performing firms are defined. For example, if firms with certain characteristics are overrepresented at the low end of the performance distribution, subsamples may introduce a selection bias that alters the results.

This observation is not contradicted when we consider the three studies that used indirect measures of risk. While Greve (1998) examined the probability of change of radio formats across the entire range of low-performance values, Ketchen and Palmer (1999) grouped low-performing hospitals in one category determined by whether performance was below the industry mean two years out of two. Again, the study that uses a research design closest to the research design of this study reports results that are consistent with the shifting-focus model of risk. Both studies report increased change in response to low performance. Greve (1998), however, differentiates in supplemental analyses between types of changes that entail different levels of risk, finding that, for the riskiest types of change, the effect of performance on change disappears, a result compatible with the shifting-focus model of risk taking. In another study that examines the entire range of low-performance values, Greve (2003a) similarly reported no effect of performance below the aspiration level on the high-risk behavior of launching innovations, but found a positive effect of low performance on the less-risky behavior of increasing R&D funding.

Overall, this comparative analysis suggests that our finding that low performance can have either a positive effect or a nonsignificant effect on risk as a result of differences in the risk behavior of small and large firms can be reconciled with studies that examine aggregate measures of risk or highly risky behaviors along the entire range of low performance. Our results imply that future studies should expect small and large firms to respond differently to low-performance and should incorporate these differences into the model. Studies that focus on a subsample of low-performing firms may be less appropriate to test the elaboration of the shifting-focus model of risk proposed in this paper.

An extension of this study would be to use the shifting-focus model to explore other organizational characteristics that influence the choice of reference point and thus explain the prevalence of risk aversion or risk seeking under low performance. For example, although we focused on firm size as an indicator of the stock of tangible resources (e.g., manufacturing infrastructures, technological capabilities, financial assets), the idea that resources can influence the choice of the reference point can be extended to intangible resources that buffer organizations and their decision makers from threat. One intangible resource is social capital, which can take the form of legitimacy, relationships with exchange partners, and trust among organization members. Lack of social capital could increase perceptions of threat when performance is low and thus contribute to decreased risk taking.

Our results also add to a small but growing body of work that seeks to incorporate the role of the organizational context in theories of organizational risk taking. Researchers have noted that theories based solely upon individual-level explanations offer unrealistic representations of how strategic decisions are made within organizations (Baird and Thomas 1985, March and Shapira 1987, Ruefli et al. 1999). One response has been to disaggregate firm-level risk into distinct operational risks, which allows exploration of whether managers exhibit heterogeneous risk preferences across choice domains (Kahneman and Lovallo 1993, Wiseman and Catanach 1997). Our study exemplifies a complementary approach by suggesting that an important feature of the organizational context, such as firm size, can moderate the effect of performance on risk behavior (Sitkin and Pablo 1992). Future research could extend this approach by exploring the role of other organizational characteristics.

The interpretation of our findings comes with some caveats related to our sample of firms. The observed range of the size variable starts at 589, which is small for a shipbuilder, but not for many other organizational forms. Thus, it is unclear whether our findings extend to industries with much smaller organizations. We believe that the theoretical argument on threat rigidity ought to apply all the way down the size gradient, because smaller means "more likely to fail" for a given form of business. However, this is an issue that merits further attention in future work. Second, shipbuilding seems an ideal context in which to study risky decisions because it is a highly capital-intensive business and is subject to fluctuations in demand. Other contexts may show a weaker adjustment of risk taking than we found in shipbuilding.

In conclusion, although the conflicting hypotheses of risk aversion and risk seeking when performance is below the aspiration level have received much attention, the paucity of empirical research has retarded progress toward the resolution of this puzzle. Our study provides evidence in support of the hypothesis of risk aversion and the moderating effect of firm size and suggests that the shifting-focus model of risk taking yields insights that can help identify when risk aversion or risk seeking prevails. Future research can extend the argument developed here by examining other organizational characteristics that might affect whether decision makers interpret risky decisions as opportunities to exceed the aspiration level or as threats to a firm's survival.

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