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Momentum and Organizational Risk Taking: Evidence from the National Football League

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This study examines how momentum shapes organizational risk taking. We define momentum as a sustained and systematic trajectory in performance over time, and we argue that such trends impact interpretations of current performance as well as expectations of future performance. Drawing on the variable focus of attention model, we posit that momentum therefore directs the focus of organizational attention between concerns of aspirations, survival, and slack. Our conceptual model accounts for momentum that occurs within a performance period as well as that which occurs across periods. We propose that within- and across-period momentums are unique in terms of *when* and *how* each type impacts risk taking. We tested and found support for our hypotheses in the context of 22,603 play-by-play decisions made by the 32 teams of the National Football League during the 2000–2005 regular season games. Theoretical and practical implications are discussed.

Key words: momentum; risk; performance feedback; attention; variable focus of attention model
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1. Introduction

Risk taking is at the center of many organizational theories. For example, it is central to understanding investments in research and development (Greve 2003a), organizational change (Greve 1998), innovation (Zollo and Winter 2002), experimentation (March 1991), and even misconduct (Harris and Bromiley 2007, Greve et al. 2010). A decision is risky to the extent that its potential outcomes vary and that at least some of those outcomes represent losses (March and Shapira 1992, Shapira 1995, Sitkin and Pablo 1992, Slovic 2000). An organization is risk seeking to the extent that its decision makers are willing to put resources at stake on such choices.

The variable focus of attention model (March and Shapira 1992, 1987) has emerged as one of the dominant frameworks for understanding when organizations are more or less likely to take risks. According to this model, risk taking is driven by feedback about performance, and the nature of this relationship depends on the focus of organizational attention. Attention can be focused on one of three objectives: reaching performance targets, avoiding threats, or experimenting with excess resources (Chen and Miller 2007; March and Shapira 1992, 1987). One of the key aims of recent research in this domain has been to discover conditions that might trigger shifts in the focus of organizational attention away from target attainment and toward concerns of survival or slack (e.g., Audia and Greve 2006, Desai 2008, Iyer and Miller 2008, Lehman et al. 2011, Miller and Chen 2004).

The objective of this paper is to introduce trends in organizational performance or "momentum" as a potential trigger of shifts in the focus of organizational attention.[1] Prior research has taken a rather static view of performance in that it has implicitly assumed that two similar firms with equal levels of performance will exhibit similar risk-taking tendencies (for reviews, see Argote and Greve 2007, Bromiley 2004, Greve 2003b). In reality, however, performance is dynamic. The two firms might have arrived at those equal levels of performance in very different ways. One might have been in a dire situation and arrived as a result of performance improvements, whereas the

[1] We acknowledge that other scholars have used the term "momentum" to refer to inertia or repetitive actions by firms (e.g., Amburgey and Miner 1992, Kelly and Amburgey 1991). Our use of the term is consistent in that we use it to refer to a sustained trend. However, our use of term diverges in that we use it to refer to a trend in *performance*. Our use is consistent with its use in the finance literature (i.e., Jegadeesh and Titman 2001, Koijen et al. 2009). It is also consistent with the use of related terms in the management literature such as "past successes" or "history of successes" (i.e., Audia et al. 2000). A more formal definition is offered in §2.1.

other might have been in a favorable position and arrived as a result of a performance decline. In other words, one might have experienced positive momentum, whereas the other might have experienced negative momentum. We posit that members of the former would be more likely to concern themselves with how to make the performance improvements continue so that targets could be achieved whereas members of the latter would be more likely to concern themselves with how to avoid the threat of further losses. These different concerns should produce different risk-taking tendencies despite equal levels of performance (March and Shapira 1992, 1987). Incorporating the role of momentum thus stands to significantly improve our understanding of the long-studied relationship between performance and risk taking.

We introduce a framework that accounts for two types of momentum—within- and across-period momentum—and we examine the unique roles of each in this study. Organizational members operate within the confines of time-bound performance periods with predefined durations and deadlines for achieving performance targets (March and Simon 1958). They seek to measure and monitor performance throughout each period (Carp 2003, Lehman et al. 2011) and, at the same time, they pay close attention to historical trends across periods (Cyert and March 1963, Greve 2003b). Momentum can therefore occur within a performance period or across periods. Using the variable focus of attention model as our foundation (March and Shapira 1992) and drawing on recent research that considers the critical role of the temporal nature of performance periods in organizational risk taking (e.g., Lehman et al. 2011), we develop a provocative argument that within- and across-period momentum will play unique roles in shaping organizational risk taking in terms of *when* and *how* each type has an effect. We propose that within-period momentum will moderate the relationship between performance and risk taking such that organizations will be less likely to take risks when the organization experiences negative rather than positive within-period momentum. However, in the absence of feedback about performance within a given period, we propose that across-period momentum will have a direct impact on risk taking such that organizations will be more likely to take risks when the organization experiences negative rather than positive across-period momentum.

By examining these distinct roles of momentum, we hope to make several contributions to the understanding of organizational risk taking. First, we offer the first systematic examination of how momentum might shape risky decisions and thus introduce an important conceptual framework to this research domain. Second, we add to the growing body of research that seeks to understand what conditions trigger shifts in the focus of organizational attention (e.g., Audia and Greve 2006, Desai 2008, Iyer and Miller 2008, Lehman et al. 2011, Miller and Chen 2004). Third, we answer general calls to better incorporate the role of time into organizational theories (e.g., Ancona et al. 2001).

We examine the role of momentum in the context of play-by-play decisions made during games in the National Football League (NFL).[2] This context offers an ideal setting for testing the proposed hypotheses because the controlled nature of the game allows for the study of discrete organizational decisions. We examine the effects of within-period momentum by testing whether a team's propensity to take risks is influenced by whether it has arrived at its current score by gaining or losing in the point spread and by how much. We examine the effects of across-period momentum by testing whether a team's propensity to take risks in a given game is dependent upon whether it has experienced a series of wins or losses in prior games. The risky decision of interest is the option of "going for it" on fourth down, which is a unique type of decision that entails a significant amount of risk. We examine 22,603 fourth down decisions made by the 32 NFL teams across 1,520 regular season games during the 2000–2005 seasons.

2. Theory and Hypotheses

2.1. The Performance–Risk Relationship Within Performance Periods

Organizations are goal-pursuant entities comprised of coalitions of members that set targets for desired levels of performance (Cyert and March 1963, March and Simon 1958). These aspirations can be based on past performance or on the performance of other organizations (Bromiley 2004, Greve 1998) and might refer to different types of financial or nonfinancial resources such as capital assets, political support, market share, organizational capital, or even reputation (March and Shapira 1992). The aspiration level refers to the "smallest outcome that would be deemed satisfactory by the decision maker" (Schneider 1992, p. 1053) or the borderline between perceived success and failure (Greve 2003b).

Aspiration levels are set within the context of temporally bound performance periods that have predefined durations and inherent deadlines for achieving desired levels of performance. Moreover, these performance periods are recurring such that organizational members pursue an aspiration level throughout a given period, and this period is then followed by

[2] Relevant details about the game are provided in §3.1 and the appendix.

another period and so on. For example, sales goals for retail consumer financial services firms might be set on a quarterly basis (e.g., Mezias et al. 2002). Sales teams receive feedback throughout each quarter about their performance relative to their goals for that quarter. At the end of the quarter, members of the sales teams can assess whether or not they reached their target, at which time a sales target for the subsequent quarter is set. Similarly, manufacturing firms often set quarterly financial objectives, and one quarter is followed by another quarter (Chen 2008); project teams set completion deadlines, and one project is followed by a new project (Conlon and Garland 1993, Humphrey et al. 2004); and sports teams aspire to score more points than their opponent in each game, and each game is followed by another game (Romer 2006). Of course, performance periods are often hierarchical in nature such that success in a given period is instrumental in the attainment of a higher-order aspiration; for example, reaching quarterly sales goals might help the firm to meet an annual target. The specific hierarchical nature of periods as well as the duration of each period thus varies widely across industries. However, a central aspect of all organizational life is the notion that aspirations are inherently temporal such that each aspiration is tied to a deadline for achieving desired levels of performance, and each performance period is followed by another period (Lehman et al. 2011).

Organizational members seek feedback about performance relative to the aspiration level on an ongoing basis throughout each period, and their chief concern is target attainment by the end of the period at hand. When performance is below the aspiration level, organizational members are more likely to take risks. In light of subpar performance, decision makers engage in a problemistic search for alternative courses of action that could resolve the performance shortfall (Cyert and March 1963). The search for possible solutions to the performance problem grows in intensity and breadth as the shortfall becomes greater. The likelihood of risk taking and the amount of risk taken consequently increases and firms engage in such activities as exploration (March 1991), change (Greve 1998), innovation (Bolton 1993, Greve 2003a), and even financial misrepresentations (Harris and Bromiley 2007). When performance is below the aspiration level, the relationship between performance and risk taking is thus negative such that risk taking increases as performance worsens.

When performance is above the aspiration level, on the other hand, organizational members are less likely to take risks. In light of performance that exceeds targets, there is little incentive for changes to well-known routines (Greve 2003b); rather, existing routines (Levitt and March 1988) and the status quo (Samuelson and Zeckhauser 1988) are reinforced. Decision makers are motivated to avoid any actions that could cause performance to fall below aspirations (March and Shapira 1987). When performance is above the aspiration level, the relationship between performance and risk taking is thus negative such that risk taking decreases as performance improves. However, risk taking tends to be less sensitive to changes in performance above the aspiration than to changes below it because the desire to preserve or extend existing resources is weaker than the desire to overcome failure (Audia and Greve 2006, Kahneman and Tversky 1979). Taken together, we follow in the footsteps of others (for reviews, see Argote and Greve 2007, Greve 2003b, Bromiley 2004) and propose the following hypotheses for the effects of performance on risk taking within a performance period.

Hypothesis 1A (H1A). *The relationship between performance and risk taking is negative*.

Hypothesis 1B (H1B). *The relationship between performance and risk taking is stronger for performance below the aspiration level than for performance above it*.

However, related theoretical perspectives (i.e., March and Shapira 1992, 1987) and empirical tests (e.g., Miller and Chen 2004, Chen and Miller 2007) suggest that organizational decisions may not necessarily be made on the basis of performance relative to aspirations all of the time because organizational attention may shift away from the aspiration level under some conditions. For example, when performance is below the aspiration level, attention may sometimes shift to concerns of survival. Survival-related concerns refer to the exhaustion of resources (March and Shapira 1992) and, although such concerns are often operationalized in terms of bankruptcy, they do not necessarily refer to the death or dissolution of the firm. Rather, a focus of attention on survival more broadly refers to the threat of distress (Altman 1983, Iyer and Miller 2008), the threat of loss of critical resources (Staw et al. 1981), or, more generally, "danger" (March and Shapira 1992). When attention is focused on survival, organizational members are less likely to engage in a problemistic search. They are instead more prone to become rigid (Staw et al. 1981) and restrict the amount of information they process (Starbuck et al. 1978). They also tend to develop a stronger need for security and are motivated to avoid negative consequences to preserve safety (Lopes 1987). Threatened organizations thus tend to become mechanistic (Hermann 1963) with an emphasis on efficiency (Starbuck 1992) and fewer new strategic initiatives (D'Aveni 1989). When performance is below aspirations and attention is focused on survival-related concerns, the negative relationship between performance and risk taking is thus

weaker than when attention is focused on the aspiration level (March and Shapira 1992). In other words, risk taking is relatively less likely.

Alternatively, when performance is above aspirations, attention may sometimes shift to slack-related concerns. Slack refers to resources in excess of current performance (Chen and Miller 2007) accumulated through outperforming aspirations (Chen 2008, Levinthal and March 1981). When attention is focused on slack-related concerns, organizational members are less cautious about making a mistake. They are instead more likely to relax controls and search for new ways of doing things. Organizations with the luxury of such performance buffers thus tend to engage in more experimentation (Singh 1986), innovation (Greve 2003a), and investments in research and development (Nohria and Gulati 1996). When performance is above aspirations and attention is focused on slack-related concerns, the negative relationship between performance and risk taking is thus weaker than when attention is focused on the aspiration level (March and Shapira 1992). In other words, risk taking is relatively more likely.

Attention tends to be focused on whichever reference point is "closer" (March and Shapira 1992). In other words, the further an organization's performance is below the aspiration level, the more likely attention is to be focused on survival and the weaker the negative relationship between performance and risk taking. In cases of extremely poor performance, this relationship may even be positive such that risk taking actually decreases as performance worsens (March and Shapira 1992, Miller and Chen 2004). Alternatively, the further an organization's performance is above the aspiration level, the more likely attention is to be focused on slack and the weaker the negative relationship between performance and risk taking. In cases of extremely high performance, this relationship may even be positive such that risk taking actually increases as performance improves (Chen and Miller 2007). Several scholars have reported various organizational and situational characteristics that impact managerial perceptions of performance and therefore trigger shifts in the focus of organizational attention away from the aspiration level and toward either survival or slack (e.g., Audia and Greve 2006, Desai 2008, Iyer and Miller 2008, Lehman et al. 2011, Miller and Chen 2004).

2.2. The Moderating Effects of Within-Period Momentum on the Performance–Risk Relationship

We propose that momentum within a performance period can act as one such a trigger that can shift the focus of attention away from the aspiration level. We define "momentum" as a systematic and sustained trajectory in performance over time in which performance is either increasing (i.e., positive momentum) or decreasing (i.e., negative momentum) as a result of successive positive or negative outcomes in a row. It can be likened to what lay people and some academics refer to as a "hot hand" or "cold foot" at the individual level (e.g., Gilovich et al. 1985). A hot hand refers to a series of positive outcomes and can thus be likened to positive momentum, whereas a cold foot refers to a series of negative outcomes and can thus be likened to negative momentum. Momentum can be large or small in terms of magnitude, long or short in terms of duration, fast or slow in terms of rate of change, and so on.[3] Within-period momentum thus refers to a trend in which performance within a period is systematically moving toward or away from the aspiration level.

We propose that within-period momentum will trigger shifts in attention because momentum shapes managerial perceptions of performance. Current research perspectives suggest that this happens in two interrelated ways. First, momentum shapes perceptions of actual or current performance. Organizational members pay attention to trends in performance because they seek to learn from past performance (Cyert and March 1963). However, they tend to weight the most recent performance more heavily because it is most salient, and the experiences are more readily available (Kahneman et al. 1982, Milliken and Lant 1991). These tendencies of "individuals as historians . . . lead to systematic biases in interpretation" of performance (Levitt and March 1988, p. 323). Organizational members could therefore be expected to assess a given level of performance with a positive bias if the firm is experiencing positive momentum or with a negative bias if the firm is experiencing negative momentum. In other words, positive momentum causes performance to appear better than it actually is, whereas negative momentum causes performance to appear worse.

Second, momentum shapes perceptions of expected or future performance. Research in various contexts has shown that decision makers look to momentum when forming expectations about future performance because they believe that past trends will naturally persist and extend into the future (Bar-Eli et al. 2006, Gilovich et al. 1985). More importantly, they are often willing to act on such beliefs. For example, mutual fund managers commonly invest more heavily in firms that have demonstrated positive momentum (Bailey et al. 2011, Jegadeesh and Titman 1993, Sapp and Tiwari 2004), and sports players are more likely

[3] We focus our theoretical discussion on the basic distinction between the effects of positive and negative momentum, but we also consider in our empirical analyses how each of these other characteristics might also play a role.

to pass the ball to a teammate who has a "hot hand" or is on a scoring streak (Bar-Eli et al. 2006). Spiral theories posit that momentum may shape expectations of future performance by impacting the collective efficacy of organizational members (Audia et al. 2000, Bandura 1991, Lindsley et al. 1995, Weick 1979); negative momentum elicits a collective belief among members that they are unable to perform tasks at a desired level, whereas positive momentum elicits a collective belief in the capability of performing such tasks. In sum, momentum plays a powerful role in shaping expectations about future performance.

Because momentum shapes managerial perceptions of performance, we posit that momentum can trigger shifts in the focus of organizational attention away from the aspiration level. Attention is indeed driven by where decision makers "are" as well as where they "expect to be" in terms of firm performance (March and Shapira 1987, p. 1413). Organizational members assess actual or current performance and, at the same time, estimate expected or future performance as either "likely underperforming" or "likely outperforming" (Chen 2008). When members of a poorly performing organization believe that future performance is expected to decline even further, they are likely to think and act in a distressed or threatened manner; in other words, they are likely to focus their attention on concerns of survival. Alternatively, when members of a high-performing organization believe that future performance is expected to improve even further, they are likely to act in a more relaxed manner; in other words, they are likely to focus their attention on experimenting with slack. In this way, assessments of current performance and expectations of future performance together guide the focus of attention between aspirations, survival, and slack. Because momentum shapes these perceptions of performance, momentum can be a powerful determinant of the focus of attention and therefore risk-taking tendencies.

Our conceptual framework therefore suggests that within-period momentum will have a moderating effect on the relationship between performance and risk taking. For a firm performing below its aspiration level, attention is more likely to shift to survival-related concerns if the organization is experiencing negative momentum than if it is experiencing positive momentum or no momentum at all. In light of negative momentum, subpar performance will be interpreted in an especially negative manner and expectations for the future will appear bleak. Consistent with the variable focus of attention model (March and Shapira 1992), the negative relationship between performance and risk taking should thus be weaker when the underperforming organization is experiencing negative within-period momentum such that the organization is less likely to take risks. In the absence of negative momentum, however, the negative relationship between performance and risk taking will be stronger because attention will remain fixed on the aspiration level.

For a firm performing above its aspiration level, on the other hand, attention is more likely to shift to slack-related concerns if the organization is experiencing positive momentum than if it is experiencing negative momentum or no momentum at all. In light of positive momentum, performance above the aspiration level will be interpreted in an especially positive manner and expectations for the future will appear encouraging. Again, consistent with the variable focus of attention model (March and Shapira 1992), the negative relationship between performance and risk taking should thus be weaker when the outperforming organization is experiencing positive within-period momentum such that the organization is more likely to take risks. In the absence of positive momentum, however, the negative relationship between performance and risk taking will be stronger because attention will remain fixed on the aspiration level. We therefore propose the following hypotheses. (See Figure 1 for a graphical representation.)

Hypothesis 2A (H2A). *For performance below the aspiration level, the negative relationship between performance and risk taking is weaker when the organization is experiencing negative within-period momentum than when it is experiencing positive within-period momentum.*

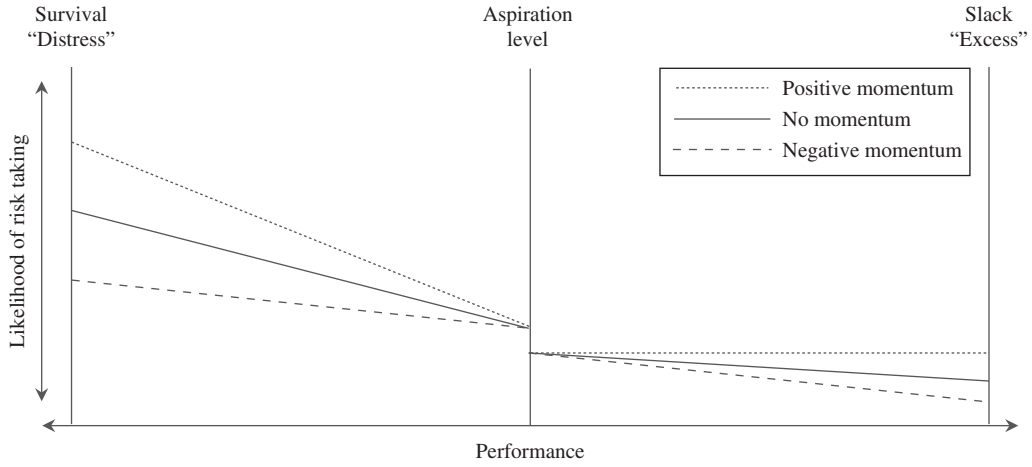
Hypothesis 2B (H2B). *For performance above the aspiration level, the negative relationship between performance and risk taking is weaker when the organization is experiencing positive within-period momentum than when it is experiencing negative within-period momentum.*

We have discussed thus far how within-period performance feedback affects organizational risk taking, and we have proposed that this relationship will be shaped by within-period momentum. However, feedback about performance within a given performance period, not to mention within-period momentum, is not always available. This is particularly true early in a performance period because organizations embark upon each period with only a target for that period (Mezias et al. 2002); feedback about performance relative to that target only becomes available with time and accumulates over time.

2.3. The Direct Effects of Across-Period Momentum on Risk Taking

We propose that across-period momentum will have a direct effect on risk taking when within-period feedback is not available early in a period. Across-period momentum refers to a trend in which performance targets are either met or not met for multiple periods

Figure 1 Proposed Moderating Effects of Within-Period Momentum



in a row. We suggest that organizational members facing risky decisions will look to feedback about target attainment in previous periods in the absence of feedback about performance relative to the target at hand. Decision makers indeed tend to make decisions on the basis of whatever information is available to them (Levitt and March 1988), and feedback about target attainment in previous periods is an available, albeit imperfect, source of feedback that can serve as a proxy for assessing current performance and expectations about future performance. Feedback about trends in performance from previous periods should have an especially strong impact. Negative across-period momentum should create a negatively biased assessment, and organizational members will expect this trend to continue such that they will likely fall short of the target at hand once again. Positive across-period momentum, on the other hand, should create a positively biased assessment, and organizational members will expect this trend to continue such that they will likely exceed the target at hand once again. Because organizational attention tends to be focused exclusively on attaining aspirations early in each period (Lehman et al. 2011), the relationship between across-period momentum and risk taking should conform to the nature of the performance–risk relationship when attention is focused on the aspiration level (March and Shapira 1992, 1987). In other words, risk taking should be more likely to the extent that across-period momentum is negative.

However, we propose that the effects of across-period momentum on risk taking will dissipate as within-period feedback becomes available. Organizational members do not need to rely on imperfect information about target attainment in previous periods once feedback about performance relative to the target in the current period becomes available. Indeed, decision makers tend to make decisions on the basis of whatever feedback is most readily available (Kahneman 1974) and most salient (Ocasio 1997). Within-period feedback will be more readily available because it will be more recent than across-period feedback; moreover, it will be more salient because it will be deemed more relevant to the target for the period at hand. We therefore propose the following hypothesis.

Hypothesis 3 (H3). *The relationship between across-period momentum and risk taking is negative but only when within-period feedback is not available.*

We have proposed a conditional main effect of across-period momentum on risk taking such that the relationship only occurs when within-period performance feedback is not available. Note that we discuss at the end of the results section an alternative model that tests this assumption and explores the possibility that the effects of across-period momentum might dissipate gradually throughout the period rather than suddenly when within-period feedback becomes available.

3. Data and Methods

3.1. Study Context[4]

We tested these hypotheses using data from play-by-play decisions made by the 32 franchise teams that comprise the NFL. The process through which risky decisions are made during a football game is consistent with traditional conceptualizations of the firm (e.g., Cyert and March 1963, March and Simon 1958). Each team comprises distinctly identifiable groups or subunits such as offense, defense, and special teams, each with its own set of coaches or managers. Moreover, decisions are preceded by a temporal gap, during which organizational members can

[4] The appendix provides a glossary of many of the football terms used in this paper.

deliberate with one another over how to proceed, and this episodic process resembles the information-based decision-making processes observed in a wide range of organizational settings.

The theoretical concepts central to our arguments are also evident in the chosen context. First, we have conceptualized organizations as goal-seeking entities that set performance targets with deadlines for attainment. The game provides a "natural" aspiration level (Greve 2003b) in that each team aspires to win the game by scoring at least one more point than its opponent. Each game lasts 60 minutes and thus represents a performance period. Team members are provided with ongoing performance feedback throughout each game via the scoreboard. The team with the most points at the end of each game is the victor, and each team then goes on to play another game against a different team the following week.

Second, momentum, which is at the core of our conceptual story, can be clearly observed in the study context. A team can experience within-period momentum when it successively scores points against an opponent (i.e., positive momentum) or when an opponent successively scores points (i.e., negative momentum) within a game. Moreover, a team can experience across-period momentum when it experiences a series of wins or loss across multiple games.

Third, each game provides several opportunities for teams to make decisions that entail risk. Each time a team has possession of the ball (i.e., the offensive team), it has up to four plays, or "downs," to move the ball at least 10 yards toward the opponent's end of the field. If the ball is moved 10 yards, the team is allowed another set of four downs. The fourth down play is unique in that it presents the offensive team with a particular set of choices, and this decision potentially carries a significant amount of risk. The team may kick or "punt" the ball to the other team, thereby giving the ball to the opponent yet ensuring in most cases that the opposing team must cover a greater distance to score; the team may attempt a field goal if they are close enough to its opponent's end of the field; or the team may attempt a fourth down conversion by trying to move the ball the remainder of the distance needed for a first down. The last option of "going for it" is traditionally considered the riskier alternative and thus represents the risky choice of interest in our study.

Fourth, we have drawn on the variable focus of attention model to posit that organizational attention can sometimes shift away from aspirations and to either avoiding threats or experimenting with slack resources (March and Shapira 1992, 1987). In the study context, neither a distinct survival point (e.g., bankruptcy) nor a clear measure of slack exists, and so performance relative to these reference points cannot be measured in the same way that performance relative to the aspirations can be measured. It is also worthwhile to note that it is not at all likely that poor performance in a single game would threaten the absolute survival of the team. Of course, it is equally unlikely that poor performance in a single financial quarter would threaten the absolute survival of most traditional organizations. However, similar to the consequences of poor performance in other organizations, teams that lose by significant margins do face the threat of a damaged reputation, and these consequences can be both severe and long lasting. For example, the consequences of just a few bad games 30 years ago still echo today for the New Orleans Saints when they face a humiliating loss and are once again labeled the "New Orleans Aints" (Fleming 1996, Tenorio 2009). Poor performance in a single game can be expected to trigger such a threat of mockery and malice expressed by fans and media. Therefore, for trailing teams (i.e., when performance is below the aspiration level), a weakened negative relationship or positive relationship between performance and risk taking suggests an organizational focus on threats and survival-related concerns (Lehman et al. 2011, Miller and Chen 2004). Similarly, for leading teams (i.e., when performance is above the aspiration level), a weakened negative relationship or positive relationship between performance and risk taking suggests an organizational focus on experimenting with excess resources. Taken together, the theoretical concepts central to our arguments can be clearly observed in the chosen study context.

3.2. Data

Data came from all regular season games played during the 2000–2005 seasons. Each season consists of seventeen weeks, during which each team plays 16 games. Following prior convention in this context (e.g., Lehman et al. 2011, Romer 2006), we excluded from our analyses plays for which the meaning of risk may be different. Specifically, we excluded those plays made during pre- and postseason games, after the two-minute warning,[5] and during overtime periods.[6] Our final data set after these exclusions consisted of 22,603 fourth down plays from 1,520 games.

[5] A warning bell is sounded two minutes before the end of the fourth quarter (see NFL 2011, Rule 4, §3). This warning bell makes the end of the game and the reduced opportunities to possess the ball very salient to teams. Consequently, the meaning of risk may be different during the last two minutes of play.

[6] A sudden-death system is used when the score is tied at the end of the regulation playing time. The team scoring first during overtime play shall be the winner of the game (see NFL 2011, Rule 16, §1). Consequently, the meaning of risk may be different during overtime play.

3.3. Variables

3.3.1. Dependent Variable. *Risk taking.* This was measured in terms of an offensive team's choice of play on a fourth down. Risk taking was coded as a binary variable (0 for no risk taking, i.e., team punted or attempted a field goal on fourth down; 1 for risk taking, i.e., the team attempted a fourth down conversion by "going for it").

3.3.2. Independent Variables. *Performance.* This was measured as the difference between current performance (i.e., the offensive team's score) and the aspiration level (i.e., the opponent's score plus one point). To take into account the different effects of performance below and above aspiration levels, we followed prior research convention (Audia and Greve 2006, Greve 1998) and created a spline function (Greene 1993). Performance at or below the aspiration level ($P \leq AL$) equals 0 when performance is above the aspiration level and equals performance minus the aspiration when performance is at or below it. Performance above the aspiration level ($P > AL$) equals 0 when performance is at or below the aspiration level and equals performance minus the aspiration when performance is above it. The inclusion of an indicator variable (1 if $P \leq AL$ and 0 if $P > AL$) allowed the curve to "jump" at the aspiration level rather than forcing the functions on either side to intersect at the same point (Greve 1998).

Within-period momentum. This was measured in terms of whether or not the offensive team was experiencing momentum in the game at hand, whether that momentum was positive (i.e., gains through scoring points against its opponent) or negative (i.e., losses through its opponent scoring points), and the magnitude of that momentum in terms of number of points scored. Momentum was considered to "start" after two "unanswered" scoring episodes occurred such that the magnitude of the momentum indicates the number of points earned or lost during the second scoring episode plus all points earned or lost in subsequent scoring episodes of the same trend. We chose to allow momentum to "start" after the second scoring episode to maintain consistency with our definition of momentum as a "systematic and sustained trajectory in performance over time."[7] A single scoring episode, on the other hand, could simply indicate back-and-forth scoring between teams and would likely not be interpreted by team members as the start of momentum. To allow for positive and negative momentum to have unique effects, two within-period momentum variables were created for inclusion in the analysis. Positive within-period momentum (+) took on a value equal to the magnitude of the momentum when the team was experiencing positive momentum; it took on the value of 0 otherwise. Similarly, negative within-period momentum (−) took on a value equal to the magnitude of the momentum when the team was experiencing negative momentum; it took on the value of 0 otherwise. For example, if a team scored two touchdowns (including one extra point per try) against its opponent and the opponent had not responded by scoring points, the focal team would have positive momentum (i.e., positive within-period momentum equals 7; negative within-period momentum equals 0) whereas its opponent would have negative momentum (i.e., positive within-period momentum equals 0; negative within-period momentum equals $|-7|$). Finally, these values underwent a log transformation (after adding 1) so as to allow the impact of momentum to vary or lessen as it increases in magnitude.

Across-period momentum. This was measured in terms of whether or not the offensive team was experiencing a series of wins or losses upon entering the game at hand and how many games had been won or lost consecutively. Momentum was considered to "start" after the second win (or loss) in a row such that the magnitude of the momentum indicates the total number of consecutive games won (or lost) starting with the second game plus all subsequent games of the same trend. This coding scheme was adopted to maintain consistency with our conceptualization of momentum as well as our measure of within-period momentum. To allow for positive and negative momentum to have unique effects, two across-period momentum variables were also created for inclusion in the analysis. Positive across-period momentum (+) took on a value equal to the number of wins when the team was experiencing a winning streak; it took on the value of 0 otherwise. Similarly, negative across-period momentum (−) took on the number of losses when the team was experiencing a losing streak; it took on the value of 0 otherwise. For example, if a team won the past three games then it would have positive momentum (i.e., positive across-period momentum equals 2; negative across-period momentum equals 0). Alternatively, if a team lost the past three games then it would have negative momentum (i.e., positive across-period momentum equals 0; negative across-period momentum equals $|-2|$). Finally, these values underwent a log transformation (after adding 1) to allow the impact of momentum to vary or lessen as it increases in magnitude.

Availability of within-period feedback. This was measured in terms of whether or not either team had

[7] Note that a scoring episode refers to any mode of scoring (i.e., touchdown, field goal, or safety) but points after touchdown are not coded as separate scoring events from the touchdown itself because both occur without the opponent taking possession of the ball, and the opponent therefore does not have the opportunity to respond. Moreover, there is no progress in the game clock between a touchdown and a try.

scored any points in the game thus far. It was coded as a binary variable (1 = some points scored; 0 = no points scored, i.e., 0–0 score).

3.3.3. Control Variables. We included several other control variables that could potentially influence fourth down decisions in a football game. Most importantly, we accounted for the amount of risk involved in each fourth down decision by controlling for the number of yards to go for first down and the number of yards to go for a touchdown (i.e., the field location). Yards to go for first down captures the variability of potential outcomes of a fourth down conversion attempt, whereas yards to go for a touchdown captures the potential cost of an unsuccessful attempt. Other control variables included the following: (a) whether the opponent is in the same division or conference because games played against teams in the same division and conference are more heavily weighted in determining postseason playoff eligibility and more is thus is at stake; (b) home field advantage because teams playing in their own stadium may feel more confident due to the familiarity of their home environment; (c) week of the game within the overall season because more may be at stake during later games in the season (e.g., postseason/playoff eligibility); (d) the amount of time remaining on the game clock because risk-taking tendencies have been shown to vary depending on proximity to deadlines; (e) the duration (in minutes) of within-period momentum because teams may be more sensitive to a persistent trajectory than a short-lived one; (f) the rate of change in within-period momentum because teams may be more sensitive to momentum that has gathered quickly than momentum that has accrued slowly; and (g) the amount of time (in minutes) since the last scoring event because teams may be more sensitive to recent events than temporally distant ones.

3.4. Data Analysis Models

Data were analyzed using logistic regression models due to the dichotomous nature of our dependent variable. Fixed-effects estimations using the *xtlogit* command in STATA were used to account for the unobservable heterogeneity between teams and also to account for any potential within-year effects. We report the coefficients, log-likelihood, and χ^2 values for each model as evidence of the effects of individual variables and the overall fit of each model.

4. Results

Table 1 provides play-level descriptive statistics of the study variables. Teams chose to "go for it" on 2,385 (10.55%) of the 22,603 fourth down plays in our data set. Fourth down conversion attempts were more likely when performance was at or below the aspiration level (12.42%) than when performance was above it (6.95%). Table 2 provides intercorrelations among these variables. Tables 3 and 4 provide the results of the logistic regressions using team- and year-level fixed effects.

Table 1 Descriptive Statistics

	Average	Std. deviation	Min	Max
(1) *Risk taking*	0.11	0.307	0.00	1.00
(2) *Performance* ($\leq$ *Aspiration*)	−4.74	6.834	−50.00	0.00
(3) *Performance* ($>$ *Aspiration*)	2.92	5.633	0.00	48.00
(4) *Minutes remaining*	30.07	16.633	2.02	60.00
(5) *Total offense points*	8.89	8.984	0.00	55.00
(6) *Yards to go for 1st down*	7.83	5.841	1.00	42.00
(7) *Yards to go for touchdown*	50.31	24.227	1.00	99.00
(8) *Same division*	0.75	0.434	0.00	1.00
(9) *Same conference*	0.42	0.493	0.00	1.00
(10) *Home field advantage*	0.49	0.500	0.00	1.00
(11) *Week of season*	9.18	4.962	1.00	17.00
(12) *Within-period momentum*	−0.52	5.955	−45.00	45.00
(13) *Within-period momentum duration*	3.32	6.862	0.00	54.00
(14) *Within-period momentum rate*	0.01	0.031	0.00	3.00
(15) *Within-period momentum recency*	12.13	9.454	0.00	57.83
(16) *Across-period momentum*	−0.59	1.828	−9.00	6.00

The models in Table 3 were used to test our hypotheses pertaining to the relationship between performance and risk taking (H1A and H1B) as well as the moderating effects of within-period momentum (H2A and H2B). Because both hypotheses pertain to those cases when within-period feedback was available, the models in Table 3 include only those cases when the score was not 0–0 ($N = 19{,}271$). Model 1 is a baseline model that includes only control variables. The effects of the risk-related control variables were significant as expected. Specifically, the likelihood of a fourth down conversion attempt was greater when fewer yards were needed for a first down ($\beta = -0.176$, $p < 0.01$) and when fewer yards were needed for a touchdown ($\beta = -0.025$, $p < 0.01$). H1A proposed that the relationship between performance and risk taking is negative, and H1B proposed that this relationship is stronger for performance below the aspiration level than for performance above it. Model 2 therefore introduces the performance variables (i.e., $P \leq AL$, $P > AL$). The overall fit of the model was satisfactory (likelihood ratio (LR) $\chi^2 = 3{,}383.34$, $p < 0.01$), and the likelihood ratio test for improvement over the baseline model was also significant (ΔLR $\chi^2 = 713.50$, $p < 0.01$). The effects of performance below the aspiration level were negative and significant ($\beta = -0.097$, $p < 0.01$), whereas the effects of performance above the aspiration level were negative but not significant (n.s.; $\beta = -0.009$); these two coefficients were significantly different from each other ($\chi^2 = 119.61$, $p < 0.01$). H1A therefore receives partial support, and H1B receives full support.

Table 2 Intercorrelations

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
(1) *Risk taking*								
(2) *Performance* (≤ *Aspiration*)	−0.238**							
(3) *Performance* (> *Aspiration*)	−0.050**	0.359**						
(4) *Minutes remaining*	−0.156**	0.204**	−0.274**					
(5) *Total offense points*	0.015*	0.261**	0.691**	−0.658**				
(6) *Yards to go for 1st down*	−0.214**	−0.050**	−0.040**	−0.017**	−0.015*			
(7) *Yards to go for touchdown*	−0.227**	−0.011+	−0.027**	0.050**	−0.015*	0.240**		
(8) *Same division*	−0.003	0.017**	−0.012+	0.006	−0.019**	0.008	0.004	
(9) *Same conference*	0.003	−0.007	0.013+	0.004	−0.006	−0.003	0.000	0.186**
(10) *Home field advantage*	0.002	0.122**	0.113**	−0.013+	0.084**	−0.018**	−0.030**	0.005
(11) *Week of season*	0.029**	0.002	0.001	−0.003	0.006	−0.011+	−0.015*	−0.041**
(12) *Within-period momentum*	−0.121**	0.626**	0.544**	0.029**	0.356**	−0.048**	−0.021**	0.004
(13) *Within-period momentum duration*	0.108**	−0.302**	0.301**	−0.338**	0.161**	−0.002	−0.055**	−0.007
(14) *Within-period momentum rate*	0.013*	−0.167**	0.026**	−0.086**	0.056**	0.008	0.052**	−0.008
(15) *Within-period momentum recency*	0.131**	−0.479**	−0.198**	−0.316**	−0.203**	0.033**	−0.079**	0.018**
(16) *Across-period momentum*	−0.003	0.015*	0.008	−0.009	0.021**	0.006	−0.010	−0.014*

	(9)	(10)	(11)	(12)	(13)	(14)	(15)
(10) *Home field advantage*	−0.004						
(11) *Week of season*	0.045**	−0.001					
(12) *Within-period momentum*	0.001	0.093**	0.003				
(13) *Within-period momentum duration*	0.019**	0.004	0.016*	−0.071**			
(14) *Within-period momentum rate*	0.006	−0.007	0.000	−0.123**	0.087**		
(15) *Within-period momentum recency*	0.011	−0.053**	0.011	−0.543**	0.468**	0.081**	
(16) *Across-period momentum*	−0.025**	0.002	−0.027**	0.017*	−0.001	0.015*	−0.026**

$^{+}p < 0.1$; $^{*}p < 0.05$; $^{**}p < 0.01$.

H2A proposed that for performance below the aspiration level, within-period momentum moderates the relationship between performance and risk taking such that the relationship is weaker when momentum is negative than when it is positive. H2B proposed that for performance above the aspiration level, the relationship between performance and risk taking is weaker when momentum is positive than when it is negative. Model 3 therefore introduces interaction terms between the within-period momentum variables and each of the performance variables. The overall fit of the model was satisfactory (LR $\chi^2 = 3{,}477.69$, $p < 0.01$), and the likelihood ratio test for improvement over Model 2 was also significant (ΔLR $\chi^2 = 94.34$, $p < 0.01$). The interaction terms in the model suggest that within-period momentum indeed moderates the relationship between performance and risk taking both for performance below the aspiration level and for performance above it. For performance below the aspiration level, the interaction terms with negative momentum ($\beta = 0.024$, $p < 0.01$) and positive momentum ($\beta = -0.030$, $p < 0.10$) are both significant and significantly different from each other ($\chi^2 = 10.73$, $p < 0.01$). For performance above the aspiration level, the interaction terms with negative momentum ($\beta = -0.040$, $p < 0.10$) and positive momentum ($\beta = 0.018$, $p < 0.01$) are also both significant and significantly different from each other ($\chi^2 = 7.34$, $p < 0.01$). H2A and H2B therefore receive full support.

Figure 2 offers a plot of the predicted probabilities based on the parameters estimated from Model 3. All covariates were set at their respective means. For a team that is trailing by three touchdowns (i.e., 21 points) and is experiencing a 14-point negative momentum (i.e., the team fell from a 7-point deficit to a 21-point deficit), the probability of going for it on fourth down is 12.36%. For a team that is trailing by the same three touchdowns but is experiencing a 14-point positive momentum (i.e., the team came back from a 35-point deficit to a 21-point deficit), the probability of going for it is 48.70%. In other words, given the same negative point spread, a team is about four times more likely to go for it if it is experiencing positive rather than negative momentum. Alternatively, for a team that is leading by three touchdowns and is experiencing a 14-point negative momentum, the probability of going for it on fourth down is 0.25%. For a team that is leading by the same three touchdowns but is experiencing a 14-point positive momentum, the probability of going for it is 1.57%. In other words, given the same positive point spread, a team is about six times more likely to go for it if it is experiencing positive rather than negative momentum. The figure clearly shows that the relationship between performance and risk taking is moderated by within-period momentum and that the nature of the moderation is consistent with our hypotheses. This moderating effect is quite strong for performance below the aspiration level yet weak for

Table 3 Fixed-Effects Logistic Regression Analysis for Likelihood of a Fourth Down Conversion Attempt: Within-Period Momentum

Predictor	Model 1	Model 2	Model 3
Yards to go for 1st down	−0.176**	−0.194**	−0.196**
	(0.007)	(0.007)	(0.007)
Yards to go for touchdown	−0.025**	−0.027**	−0.027**
	(0.001)	(0.001)	(0.001)
Same division	−0.046	0.012	0.017
	(0.058)	(0.061)	(0.061)
Same conference	0.005	−0.003	0.000
	(0.052)	(0.054)	(0.055)
Home field advantage	0.006	0.163**	0.168**
	(0.051)	(0.053)	(0.053)
Week of season	0.020**	0.022**	0.024**
	(0.005)	(0.005)	(0.005)
Minutes remaining	−0.061**	−0.033**	−0.033**
	(0.002)	(0.003)	(0.003)
Total offense points	−0.062**	0.007	0.006
	(0.004)	(0.005)	(0.006)
Performance ≤ *Aspiration* (H1A, H1B)		−0.097**	−0.138**
		(0.004)	(0.007)
Performance > *Aspiration* (H1A, H1B)		−0.009	−0.034**
		(0.008)	(0.012)
Indicator variable		0.099	−0.393**
		(0.094)	(0.113)
Within-period momentum duration			0.000
			(0.000)
Within-period momentum rate			−1.313
			(1.467)
Within-period momentum recency			0.000
			(0.000)
Within-period momentum (−)			0.244**
			(0.064)
Within-period momentum (+)			−0.232**
			(0.083)
Performance ≤ *Aspiration* × *Within-period momentum* (−) (H2A)			0.024**
			(0.003)
Performance ≤ *Aspiration* × *Within-period momentum* (+) (H2A)			−0.030+
			(0.016)
Performance > *Aspiration* × *Within-period momentum* (−) (H2B)			−0.040+
			(0.021)
Performance > *Aspiration* × *Within-period momentum* (+) (H2B)			0.018**
			(0.005)
Number of observations (*N*)[a]	19,271	19,271	19,271
Log-likelihood	−5,298.191	−4,941.441	−4,894.269
LR χ^2	2,669.85**	3,383.34**	3,477.69**
d.f.		3	6
ΔLR χ^2		713.50**	94.34**

Notes. Team-level and year-level fixed effects were included in the analysis. Numbers reported represent coefficients; standard errors are shown in parentheses.
[a]All cases for which within-period performance feedback was available (i.e., the score was not 0–0) are included here.
$^{+}p < 0.1$; $^{**}p < 0.01$.

performance above the aspiration level. This figure thus lends further support for H2A and H2B.

The models in Table 4 were used to test our hypothesis pertaining to the relationship between across-period momentum and risk taking (H3). Because this hypothesis pertains to those cases when within-period feedback was not available, the models in Table 4 include only those plays when the score was 0–0 ($N = 3{,}332$) with the exception of the final model, which includes all plays ($N = 22{,}603$) and allows us to test the conditional nature of the main effect proposed. Model 4 is a baseline model that includes only control variables. The effects of the risk-related control variables were again significant as expected.

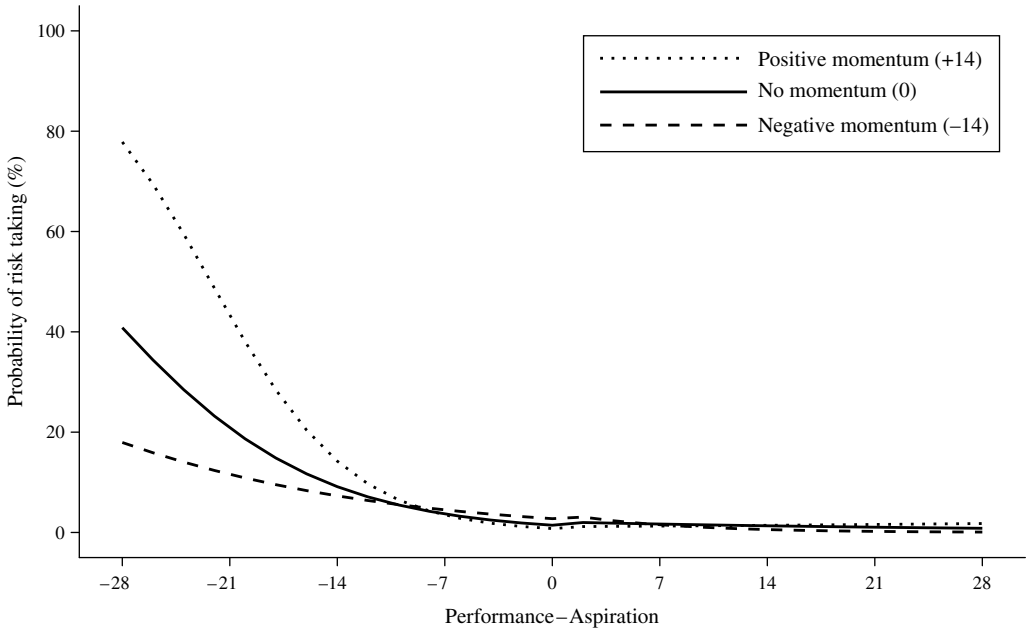
Table 4 Fixed-Effects Logistic Regression Analysis for Likelihood of a Fourth Down Conversion Attempt: Across-Period Momentum

Predictor	Model 4	Model 5	Model 6
Yards to go for 1st down	−0.442**	−0.446**	−0.209**
	(0.038)	(0.038)	(0.007)
Yards to go for touchdown	−0.026**	−0.026**	−0.027**
	(0.003)	(0.003)	(0.001)
Same division	0.156	0.142	0.020
	(0.188)	(0.188)	(0.058)
Same conference	0.094	0.092	0.001
	(0.159)	(0.160)	(0.051)
Home field advantage	0.153	0.158	0.165**
	(0.154)	(0.154)	(0.050)
Week of season	0.028+	0.021	0.023**
	(0.016)	(0.016)	(0.005)
Minutes remaining	0.003	0.004	−0.032**
	(0.013)	(0.013)	(0.002)
Total offense points			0.009+
			(0.005)
Performance (≤ *Aspiration*)			−0.099**
			(0.004)
Performance (> *Aspiration*)			−0.011
			(0.008)
Indicator variable			0.093
			(0.094)
Across-period momentum (−): *Within-period feedback not available* (H3)		0.540**	0.347*
		(0.194)	(0.136)
Across-period momentum (+): *Within-period feedback not available* (H3)		−0.170	−0.153
		(0.230)	(0.179)
Across-period momentum (−): *Within-period feedback available* (H3)			−0.021
			(0.069)
Across-period momentum (+): *Within-period feedback available* (H3)			−0.065
			(0.071)
Availability of within-period performance feedback dummy			−0.699**
			(0.125)
Number of observations (*N*)[a]	3,332	3,332	22,603
Log-likelihood	−533.843	−531.461	−5,580.409
LR χ^2	411.22**	415.99**	3,803.18
d.f.		1	
ΔLR χ^2		4.76*	

Notes. Team-level and year-level fixed effects were included in the analysis. Numbers reported represent coefficients; standard errors are shown in parentheses.
[a]All cases for which within-period performance feedback was *not* available (i.e., the score was 0–0) are included here with the exception of Model 6, which includes all plays (i.e., it includes the 3,332 plays for which the score was 0–0 as well as the 19,271 plays for which the score was not 0–0).
$^+p < 0.1$; $^*p < 0.05$; $^{**}p < 0.01$.

Specifically, the likelihood of a fourth down conversion attempt was greater when fewer yards were needed for a first down ($\beta = -0.442$, $p < 0.01$) and when fewer yards were needed for a touchdown ($\beta = -0.026$, $p < 0.01$). H3 proposed that the relationship between across-period momentum and risk taking is negative but only when within-period feedback is not available. Model 5 therefore introduces the across-period momentum variables. The overall fit of the model was satisfactory (LR $\chi^2 = 415.99$, $p < 0.01$) and the likelihood ratio test for improvement over the baseline model was also significant (ΔLR $\chi^2 = 4.76$, $p < 0.05$). The effects of both across-period momentum variables were in the expected direction. Negative across-period momentum had a positive effect ($\beta = 0.540$, $p < 0.01$) such that the probability of going for it on fourth down increased as the absolute value of the number of losses in a losing streak increased. Alternatively, the coefficient for positive across-period momentum was negative but this effect was not significant ($\beta = -0.170$, n.s.). H3 therefore receives preliminary partial support. Model 6 introduces a dummy variable for the availability of within-period feedback (i.e., the dummy variable is equal to 0 for the 3,332 plays for which the score was 0–0 and is equal to 1 for the 19,271 plays for which the score was not 0–0) and an interaction between the dummy variable and each of the across-period momentum variables; the performance variables were also included. The overall fit of the model was satisfactory (LR $\chi^2 = 3,803.18$,

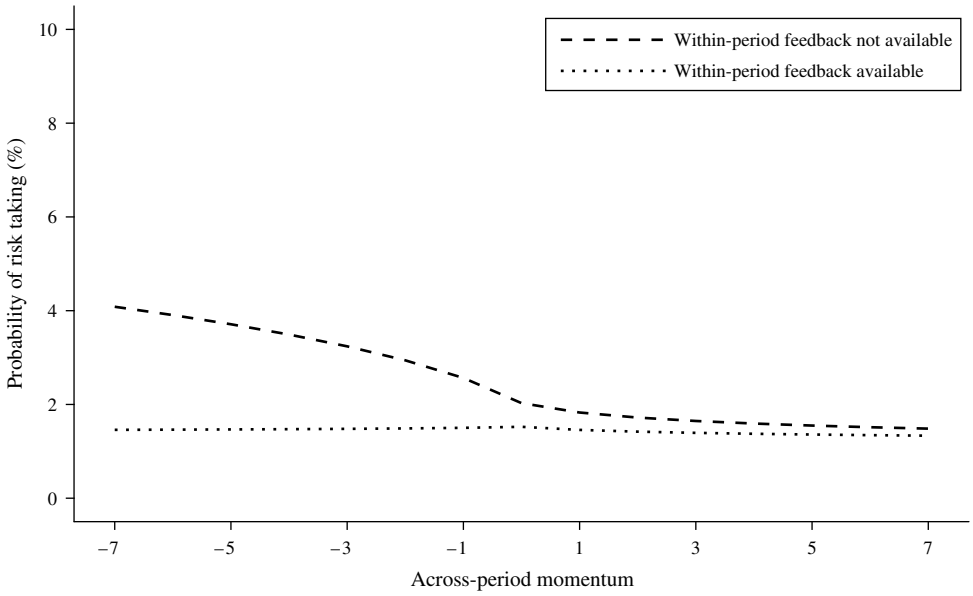
Figure 2 **Summary of Estimated Predicted Probabilities of a Fourth Down Conversion Attempt: Within-Period Momentum**



$p < 0.01$), and the effects of negative across-period momentum remain significant when within-period feedback was not available ($\beta = 0.347$, $p < 0.05$) but are not significant when within-period feedback was available ($\beta = -0.021$, n.s.). This model suggests that the effects of across-period momentum on risk taking were no longer present after the first scoring episode of the game. We therefore conclude that H3 receives partial support; it is supported in the case of negative across-period momentum but not in the case of positive across-period momentum.

Figure 3 offers a plot of the predicted probabilities based on the parameters estimated from Model 6. All covariates were again set at their respective means. For a team entering a game after a four-game losing streak and with a score of 0–0 in the current game, the probability of going for it on fourth down is 3.24%. However, for a team entering a game after a four-game winning streak and with a score of 0–0 in the current game, the probability of going for it is 1.65%. In other words, the team with the four-game losing streak is twice as likely to go for it

Figure 3 **Summary of Estimated Predicted Probabilities of a Fourth Down Conversion Attempt: Across-Period Momentum**



on fourth down than the team with the four-game winning streak. However, this difference disappears when within-period feedback becomes available and the score is thus no longer 0–0 (i.e., in cases when the score is *not* 0–0, the probability of going for it with a four-game losing streak is 1.48%, and the probability of going for it with a four-game losing streak is 1.39%; the difference is not statistically significant). The figure clearly shows that the relationship between across-period momentum and risk taking is negative when within-period feedback is not available but that this relationship dissipates when such feedback is available. This figure thus lends further support for the conditional main effects proposed in H3.

We also conducted some additional post hoc analyses in an effort to better understand the role of across-period momentum. We did this by creating an alternative interaction model with minutes remaining. Whereas the interaction model with within-period feedback availability (i.e., Model 6) assumes that the effects of across-period momentum on risk taking dissipate suddenly, the alternative interaction model challenges this assumption and allows the effects to dissipate gradually over time. The interaction terms were not significant in the alternative model, thereby lending some support to the notion that the effects of across-period momentum on risk taking dissipate suddenly after either team scores.

5. Discussion and Conclusions

We set out to understand the unique effects of within- and across-period momentum in shaping organizational risk taking. Our hypotheses were largely supported by the results of our analyses of 22,603 fourth down decisions made by the 32 NFL teams across 1,520 games over six seasons. Consistent with a long tradition of prior research (see Argote and Greve 2007), the relationship between performance and risk taking was negative, and this relationship was stronger for performance below the aspiration level than for performance above it. As hypothesized, within-period momentum moderated this relationship. For performance below the aspiration level, the relationship between performance and risk taking was weaker when momentum was negative than positive. In other words, given the same level of performance below the aspiration level, an organization was less likely to take risks if it had experienced negative momentum compared to positive momentum. For performance above the aspiration level, the relationship between performance and risk taking was weaker when momentum was positive than negative. In other words, given the same level of performance above the aspiration level, an organization was more likely to take risks if it had experienced positive momentum compared to negative momentum. Also as hypothesized, the relationship between across-period momentum and risk taking was negative, but this relationship was only present at the start of a period before within-period performance feedback was available.

These findings are consistent with our position that across- and within-period momentum play unique roles in terms of *when* and *how* they shape risk taking. Across-period momentum appears to only impact risky decisions early in a period before within-period feedback is available; within-period momentum impacts risky decisions after such feedback becomes available. In other words, organizational members seem to embark upon a performance period with a lack of feedback and information about previous target attainment is thus used early in a period as an imperfect yet available source of feedback. However, the impact of previous target attainment dissipates as more relevant feedback becomes available in the current period. In a sense, within-period momentum replaces across-period momentum in shaping risk taking. The two types of momentum are also unique in terms of how they shape risky decisions. Risk taking was less likely to the extent that within-period momentum was negative; however, risk taking was more likely to the extent that across-period momentum was negative. Within-period momentum seems to act as a potential trigger that can shift the focus of attention away from the aspiration level. For underperforming firms, the lower likelihood of risk taking in light of negative momentum compared to positive momentum is consistent with a shift in focus to survival-related concerns. Alternatively, for outperforming firms, the higher likelihood of risk taking in light of positive momentum compared to negative momentum is consistent with a shift in focus to slack-related concerns. Across-period momentum, on the other hand, seems to serve as a sort of proxy for evaluating performance early in a performance period, which is the time when attention is most likely to be focused on the aspiration level (March and Simon 1958, Lehman et al. 2011). This study therefore not only highlights the importance of accounting for momentum when estimating organizational risk taking, it also highlights the importance of considering the type of momentum.

This study extends our understanding of organizational risk taking in several ways. First, this study is, to the best of our knowledge, the first systematic examination of how momentum shapes organizational risk taking. Not only does this study introduce a new and important conceptual framework for understanding risk taking, it has broad-reaching implications for other aspects of behavioral theory of the firm. For example, a momentum framework can

be used to help us understand the ongoing adaptation of historical aspiration levels. Prior research has shown that aspirations adapt as a function of past performance (Lant 1992), and it is possible that decision makers in an organization that ends a period with positive within-period momentum may be upwardly biased when it comes to forming targets for the future. In addition, a momentum framework could be used to help us understand the managerial formation of social aspirations. Performance targets are often based, at least in part, on the performance of other organizations (Cyert and March 1963, Greve 2003b), and it is possible that a widely publicized trend in performance for one firm may influence the formation of aspirations in another firm. Moreover, accounting for the momentum of a focal firm as well as its peers may help us to better understand the relative impact of historical versus social inputs in aspiration formation and adaptation. Performance targets are indeed often based on inputs about historical and social performance; it is possible that inputs about historical performance may carry more weight if the focal firm is experiencing momentum, whereas inputs about social performance may carry more weight if peer firms are demonstrating momentum. Second, this study adds to the growing body of research that seeks to better understand contingencies of the variable focus of attention model (e.g., Audia and Greve 2006, Desai 2008, Iyer and Miller 2008, Lehman et al. 2011, Miller and Chen 2004). We lend support to past tests of the model, but we also extend these findings by suggesting that momentum should be recognized as a potential trigger of shifts in the focus of organizational attention between aspirations, survival, and slack. Third, this study responds to general calls to better incorporate the role of time into organizational theories (e.g., Ancona et al. 2001) by highlighting the fact that organizations operate within the context of time-based performance periods.

Some potential limitations of our study should be considered. First, our findings might be specific to our study context. We have noted how the decision-making processes in a football game are consistent with traditional conceptualizations of the firm. We also recognize that several of the idiosyncrasies unique to our study context enabled us to examine our hypotheses in terms of discrete decisions; however, these same idiosyncrasies might also limit the generalizability of our findings. For example, a 60-minute game represents a much shorter performance period than the periods representative of many other settings. In addition, a football game represents a winner-take-all context in which a team wins regardless of the final point spread, whereas the margin of target attainment or shortfall is notably more important in many other contexts. We offer this study as a first step in understanding the role of momentum, and we believe that the decision processes in the professional sports context stand to provide useful insights into organizational cognition and behavior. Of course, we encourage future research to determine the extent of the generalizability of these findings. Second, our study context did not offer a clear way to explicitly measure how momentum shapes perceptions of performance. We proposed two interrelated ways by suggesting that momentum shapes perceptions of actual or current performance as well as perceptions of expected or future performance. We believe that our empirical findings are consistent with this theoretical framework, but future research should seek to clearly measure the cognitive process through which momentum shapes perceptions of performance.

Our study also opens the door for several future research questions to be explored. First, how might various characteristics of momentum create variations in the reported relationships? Due to the already complex nature of our analysis models, we simply controlled for such characteristics as duration and rate. Future researchers may consider an overall measure of momentum "strength" that incorporates each of these characteristics. Second, what is the cognitive process through which decision makers turn from across- to within-period momentum? Our findings and additional analyses reported suggest that risky decisions are no longer influenced by performance in previous periods as soon as feedback within a given period becomes available. Future researchers may consider other data collection methods that would allow for this cognitive process to be captured. Third, how might the introduction of multiple forms of feedback create variations in the reported relationships? Our study context provided a single and obvious measure of performance: point spread. However, other researchers in this domain have noted that aspiration levels in some contexts might be based on historical performance, social performance, or both (Baum et al. 2005, Cyert and March 1963, Greve 2003b). It is conceivable that an organization could experience positive momentum in terms of historical performance and, at the same time, negative momentum in terms of social performance, or vice versa.

Our study points to some practical implications as well. For example, managers may be able to better predict the risk-related behaviors of competing firms by considering the performance trajectories of those firms. Managers may also be able to better understand risk-related behaviors in their own firms by recognizing that equal performance is not necessarily created in equal ways; this recognition may help to better encourage desirable risk taking as well as mitigate undesirable risk taking. Those managers who are able to anticipate the risk-taking tendencies of competitors and regulate the risky decisions of employees should find themselves administering more effective

and reliable organizations. However, the implications of our momentum framework extend beyond just the manager. For example, analysts may be able to provide better forecasts of firm behaviors by taking momentum into account. Moreover, individual and mutual fund investors may be able to better align their investments with their risk preferences by considering the momentum of the firms in which they invest. Taken together, a momentum framework should help theorists and practitioners alike better understand organizational decisions that entail risk.

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Appendix

Glossary of Relevant Terms Related to Professional American Football

Down: A Down is a period of action that starts when the ball is put in play and ends when the ball is next dead (NFL 2011, Rule 3, §7).

Field Goal: A Field Goal is made by kicking the ball from the field of play through the plane of the opponents' goal by a drop kick or a placekick either from behind the line of a play from scrimmage or during a fair catch kick (NFL 2011, Rule 3, §10).

First Down: The initial down in each series is known as the First Down, and if it is a charged down, subsequent charged downs are numbered consecutively until a new series is declared for either team (NFL 2011, Rule 3, §7).

"Going For It:" An attempt by the offensive team on Fourth Down to move the football the remaining distance needed to reach the Necessary Line (colloquial term; also called a Fourth Down Conversion Attempt).

Offense and Defense: Whenever a team is in possession [of the ball] it is the Offense, and, at such time, its opponent is the Defense (NFL 2011, Rule 3, §35).

Punt: A Punt is a kick made by a kicker who drops the ball and kicks it while it is in flight (NFL 2011, Rule 3, §26).

Safety: A Safety is the situation in which the ball is dead on or behind a team's own goal line provided the impetus came from a player of that team and it is not a touchdown (NFL 2011, Rule 3, §28).

Series of Downs: A Series of Downs is the four consecutive charged scrimmage downs allotted to the offensive team during which it must advance the ball to a yard line called the necessary line to retain possession. The Necessary Line is always 10 yards in advance of the spot of the snap (which starts the series) except when a goal line is less than 10 yards from this spot. In that case, the necessary line is the goal line (NFL 2011, Rule 3, §7).

Touchdown: A Touchdown is the situation in which any part of the ball, legally in possession of a player inbounds, is on, above, or behind the opponent's goal line (plane), provided it is not a touchback (NFL 2011, Rule 3, §38).

Try: A Try is an opportunity given a team that has just scored a touchdown to score an additional one or two points during one scrimmage down (NFL 2011, Rule 3, §7).

Value of Scores: Points are scored as follows: (a) a Touchdown is 6 points; (b) a Field Goal is 3 points; (c) a Safety is 2 points; (d) a Successful Try after a Touchdown is 1 point (Field Goal or Safety) or 2 points (Touchdown) (NFL 2011, Rule 11, §1).

Yard Line: A Yard Line is any line and its vertical plane parallel to the end line. The Yard Lines (marked or unmarked) in the field of play are named by number in yards from a team's goal line to the center of the field (NFL 2011, Rule 3, §41).

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