Attainment discrepancy, organizational slack, and prospect framing; behavioral consequences of exploitation and exploration on risk preferences

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Abstract

The selection on the mode of organizational learning is said to be affected by managers' risk preferences. However, scholars have largely neglected the effects organizational learning has on succeeding risk preferences. By discussing organizational learning from behavioral perspectives, we show exploitative learning primes risk-seeking behaviors in the stable competitive environments, while risk-averse behaviors result from exploitative learning in the unstable competitive environments. As for explorative learning, we deduce exploring managers grow more risk-averse irrespective of the level of competitive environments stability. Our results provide behavioral explanations on the cyclical dynamics of organizational learning.

The research on exploitation and exploration has been firmly rooted on our understanding about risk preferences. This is primarily because these two organizational learning patterns are distinctly different not only in terms of search direction, but also in terms of risks associated with them. As managers pursue more and more explorative learning, they are more likely to suffer disappointing results either in positive or in negative extremes. In other words, the result from exploration is more volatile and variance-enhancing (Benner & Tushman, 2002; McGrath, 2001). On the other hand, exploitation, a polar counter-part for exploration, is mean-enhancing (*ibid.*), in that managers are able to realize more and more reliable results by repeating exploitative learning. Exploiting organizations may not enjoy spectacular success, but at the same time, they do not have to worry about unexpectedly unfavorable results. One important consequence of this dichotomous comparison is that exploitation is said to crowd out exploration (Levinthal & March, 1993; March, 1991). Because managers are risk-averse in most of the cases, the balance between exploitation and exploration easily gets skewed in favor of more frequent

exploitation.

This reasoning shows a very close relationship between risk preferences and exploitation / exploration argument. However, preceding research has primarily focused on how risk preference affects the choice between exploitation and exploration. In other words, the effects of different learning types on ensuing risk preference are relatively unstudied. It could also be said that the traditional perspective sees organizational learning as discreet, in that each learning is considered as mutually independent.

However, organizational learning is more sequential in actual organizational contexts. Moreover, the observed level of managers' risk preference is more strongly affected by how they shift their attention upon preceding learning, than by their coherent risk preference (March & Shapira, 1987; Miller & Chen, 2004). In other words, ensuing learning should be under a significant influence of preceding learning.

The current paper tries to fill this gap by linking behavioral theory of organization and the theory of organizational learning. More specifically, how exploitation / exploration affects three antecedents for risk preference, i.e., attainment discrepancy, organizational slack, or prospect framing, is discussed. These antecedents then affect the type of organizational learning in turn, closing the cyclical sequence of organizational learning in which exploitation and exploration primes each other (Crossan, Lane, & White, 1999; Nooteboom, 2000; Zollo & Winter, 2002). In other words, our aim is to clarify sequential dynamics of exploitation and exploration from a behavioral perspective.

Antecedents for risk preference

Scholars have found various antecedents for risk-seeking behaviors, since it is widely understood that managers do not necessarily behave in a way they maximize expected returns as is assumed in economics literature (Cyert & March, 1963; Nelson & Winter, 1982). Managers behave in more risk-seeking manners in some times, while at other times more risk-averse behaviors are commonly observed. Boundary conditions for these distinct consequences are sought for among various preceding contexts in which managers make decisions. As always, managers' decisions are heavily context dependent.

Among these conditions, three related, but distinct streams of perspectives have been most heavily discussed. They are attainment discrepancy, organizational slack, and prospect framing. Not only they have drawn many scholars' interests, theoretical

backgrounds for these perspectives are quite distinct, and complementary. The arguments on attainment discrepancy are developed in the literature on organizational learning, and to a lesser extent, on institutionalization. Organization's relative performance and the formation of aspiration level are the major contextual factors discussed in this literature (Cyert & March, 1963). In contrast, the theory of resource dependency underlies the prediction on organizational slack's effects on risk preference. Scholars focus on the amount of managers' discretion as an important contextual factor (Nohria & Gulati, 1996; Singh, 1986). Finally, prospect framing is based on a unique individual psychology, called "certainty effect (Kahneman & Tversky, 1979)." From the perspective of prospect framing, a path-dependent nature of managers' risk preference formation is emphasized. With these diverse but complementary perspectives being combined, we are able to consider managers' risk preference formation from a comprehensive perspective, encompassing organizations' inherent nature of profit-orientation, resource constrained, and path-dependency. In addition, these three streams of arguments also provide distinct explanations why managers behave in more or less risk-seeking manners. We discuss them in tern below.

Attainment discrepancy: Managers' aspiration level plays an important role in the formation of risk preference, because unfavorable performance relative to the aspiration level triggers more risk-seeking behaviors (Bromiley, 1991; Cyert & March, 1963; Greve, 1998; Lant, Milliken, & Batra, 1992; March & Simon, 1958; Miller & Chen, 2004; Wiseman & Bromiley, 1996). The argument on aspiration level is concerned with how managers perceive consequences of learning and of associated behaviors. The perception is either positive or negative, depending on the relative relationship between aspiration level and actual performance level, or the attainment discrepancy (Lant & Montgomery, 1987; Lant, 1992). If actual performance level is perceived as below the aspiration level (i.e., in the case of negative attainment discrepancy), managers behave in more risk-seeking manner[1]. In other words, managers feel ready to take more risk only when they are desperate enough to try even unproven approaches.

The case in point here is organizations at "stalemate in technology (Mensch, 1979)" or "technology exhaustion (Ahuja & Katila, 2004)." Managers try a new technological field when they feel their current technology is exhausted in that marginal return from their continuing investment is diminishing. Stated differently, diminishing performance forces managers to take more risk. Conversely, managers behave in risk-averse manners when

they perceive their performance is above the aspiration level.

The relationship between relative level of actual performance and risk-seeking behaviors is not necessarily linear when the magnitude of negative attainment discrepancy gets excessive. Scholars have shown managers feel they are close to a survival point (or survival level) under too unfavorable organizational performance (Audia & Greve, 2006; March & Shapira, 1987). In the neighborhood of a survival point, managers behave in quite risk-averse manners since even a minor miss-step could jeopardize their organization's survival. As a consequence, the relationship between relative level of actual performance and risk-seeking behavior is curvilinear (inverted U-shape) if extremely low performance is also taken into account.

Another factor that further complicates the relationship between relative level of actual performance and risk seeking behavior is the fact that organizations continuously adjust their aspiration level (Herriott, Levinthal, & March, 1985; Lant & Montgomery, 1987; Lant, 1992; Levinthal & March, 1981; March, 1988). In fact, adaptations of aspiration levels can be a source of higher survival rate and higher average return, when combined with variable risk preferences (March, 1988).

The adjustment is made based on the performance level of previous periods, and on how well competing organizations are doing. Specifically, if organizations perceive their performance is below the aspiration level, they lower the aspiration level so that under-performance will not be repeated. Likewise, positive attainment discrepancy should unlikely be continuous, because the aspiration level is adjusted upward. Interestingly enough, this adjustment is found to be rather quick, and sometimes excessive (Audia & Greve, 2006; Lant, 1992). Although relatively slow adjustment is shown to be associated with higher organizational survival (March, 1988), boundedly rational managers do not necessarily follow this normative recommendation.

Therefore, we expect that only a substantial discrepancy between the aspiration level and the actual performance would eventually affect risk taking behaviors. In other words, managers resolve minor discrepancies between the aspiration level and the actual performance by adjusting their aspiration levels before changing their risk preference characteristics.

Organizational slack: Another behavioral source of risk preference formation is organizational slack. Organizational slack is originally defined as "a disparity between the resources available to the organization and the payments required to maintain the coalition

(Cyert & March, 1963, p. 42)." Although it is operationalized in various different ways, the most general distinction is on whether excess resources are readily available for immediate use or not. Labeled as unabsorbed (Sigh, 1986), available or recoverable (Bromiley, 1991; Wiseman & Bromiley, 1996), short-term (Nohria & Gulati, 1996), or uncommitted (Mone, McKinley, & Barker, 1998), those slacks more readily available for immediate use (or reallocation) have been found to affect managers' risk talking behaviors. Namely, scholars have shown more organizational slack leads to risk seeking, up to a certain amount (Greve, 2003; Lant, Milliken, & Batra, 1992; Nohria & Gulati, 1996; Singh, 1986). Especially, accumulation of uncommitted resources is important (Mone, McKinley, & Barker, 1998).

Thus, these arguments on organizational slack are concerned with how learning and associated behaviors affect the amount of organization's available resources. As organizations accumulate more resources, managers are less concerned about the possibility that they lose some portion of resources for unsuccessful trials. Organizational slack also allows managers to deploy resources under more relaxed controls and less certainty (Nohria & Gulati, 1996). Accumulated resources are also associated with more positive effects. They enable managers for wider environmental scanning and higher awareness on changes in their organization's environmental context (Lant, Milliken, & Batra, 1992). In an effort to extend the prospect theory (Kahneman & Tversky, 1979), Thaler & Johnson (1990) described more resourceful organization's risk-seeking nature as a "house money effect."

However, the relationship between organizational slack and risk-seeking behaviors is not necessarily linear. This is because too much resourcefulness is associated with decreased discipline (Nohria & Gulati, 1996). Managers without due amount of discipline indulge themselves in repeating routine operations, keeping away from taking challenging opportunities. In other words, too much organizational slack is associated with less risk taking behaviors. Consequently, the overall relationship between organizational slack and the level of risk seeking behaviors is curvilinear (inverted U-shape).

Some authors argue for an opposite relationship, where decreased slack leads to more risk-seeking (Wiseman & Bromiley, 1996), or to no conclusive results at all (Bromiley, 1991). However, their results are not directly comparable to others discussed above. It is because they operationalize risk with a measure of realized risk (i.e., a standard deviation of analysts' forecasts on earnings per share), perhaps being too consistent with established manners in the finance discipline. Unfortunately, realized risk can deviate from managers'

intended risk (Bromiley, 1991; Miller & Chen, 2004). For example, Miller & Chen (2004) operationalize risk with another measure of realized risk, i.e., a standard deviation of return on assets. As a result, they find out that managers at organizations threatened by bankruptcy behave in more risk-seeking manners, which disproves their hypothesis (Miller & Chen, 2004)[2]. Since it is managers' perceived risk, but not realized risk that affects their risk-seeking behaviors, we feel it reasonable to expect positive association between the amount of organizational slack and the risk-seeking behaviors, at least up to a certain threshold.

Prospect framing: The argument on prospect framing has shown the domain of losses promotes more risk-seeking, while the domain of gains promotes more risk-averseness (Kahneman & Tversky, 1979). This argument is primarily concerned with how learning and associated behaviors affect the context of ensuing learning.

The learning might be either in the context of positive domain (i.e., domain of gains) or of negative domain (i.e., domain of losses). When in the positive domain, consequences of learning initiatives are evaluated in terms of how much gain could be maintained. On the other hand, considerations on how much losses could be recovered dominate our thinking in the loss domain. People behave in more risk-seeking manners in the negative domain because of a "certainty effect (Kahneman & Tversky, 1979)," under which they prefer a loss that is merely probable over a smaller, but certain loss. In other words, a certain loss is perceived larger than actual, making a probable loss relatively more attractive even though its expected value is more unfavorable than a certain loss[3].

Although this perspective is often confused with that on attainment discrepancy discussed above, these two perspectives are quite distinct. The most notable difference is that the prospect theory is concerned with the way a prospect (i.e., future return) is framed (as its name properly indicates), while attainment discrepancy is concerned with how past performances are perceived. Secondly, negative attainment discrepancy is not necessarily in a domain of losses, particularly when the aspiration level is set aggressively. Managers at those organizations feel they are under-performing while they actually are profitable. Finally, attainment discrepancy is recognized in an organizational process, while prospect framing is basically an individual manager's psychological process. As is described above, attainment discrepancy is recognized by comparing actual performance and the aspiration level. The aspiration level is set as a result of managers interactions including negotiation and coalition building (Cyert & March, 1963). In contrast, prospect framing is

an aggregation of individual manager's psychological processes. As such, no significant interactions among managers are involved in the process of prospect framing.

Thus, the original argument on the prospect framing has been developed in the context of individual's perceptual process. However, several management scholars report consistent findings that support the validity of the prospect theory's application to managers' risk preference. One example is the threat perception that enables managers to get rid of resource rigidity (Gilbert, 2005), i.e., an obstacle for resource allocation to discontinuous initiatives.

Careful reading of the original argument on prospect framing (Kahneman & Tversky, 1979) indicates that three factors decide whether a manager is in the positive domain or in the negative domain. They are the continuity of managers' perception, the amount of previous gains or losses, and the direction of previous returns.

Obviously, previous returns should be positive (negative) in order to experience the positive (negative) domain. In addition, minor level of previous gains or losses would not be enough to create neither positive nor negative domain. This is because the positive (negative) domain dominates only when previous gains (losses) outweigh the focal prospect. In other words, only substantially large amount of losses (relative to the focal prospect) promotes risk-seeking behaviors. The case in point is an entrepreneur who has not yet adapted to recent significant losses, and evaluates his or her alternatives from the perspective of how much of the loss could be recovered (Kahneman & Tversky, 1979). Conversely, if previous gains outweigh the focal prospect, the positive domain dominates decision makers' thinking, leading to risk-averse behaviors. Finally, and the most importantly, these effects are only valid when managers perceive previous gains or losses as continuous. If the focal prospect is perceived as discrete from previous gains or losses, no specific perceptual domain would be formed, thus, the effect of prospect framing should be neutral.

One of the most serious theoretical criticisms against the prospect theory comes from those scholars arguing for threat rigidity effects (Staw, Sandelands, & Dutton, 1981). This research predicts managers at organizations in a close danger of survival will act in more risk-averse manners. It is because managers under the threat perception rely more on restricted information, centralized decision making, proven approaches, and on existing resources (*ibid.*). Similar effects have also been found in the context of individual's decision making where people grow more sensitive to an additional loss after preceding ones

(Thaler & Johnson, 1990). Therefore, predicted behaviors are quite different for managers at organizations under adversarial situations. According to the prospect theory, they behave in more risk-seeking manners, while threat rigidity perspective predicts they should be more risk-averse.

Recent efforts have provided various fruitful perspectives that fill the gap between these seemingly competing schools of thoughts. Some authors try to see them being applied to distinct aspects of the linkage between the negative domain perception and risk seeking behaviors, i.e., "resource rigidity" and "routine rigidity" (Gilbert, 2005) or direct and indirect influence (Lant, Milliken, & Batra, 1992). Others focus their attentions on the differences in decision making contexts, including managers' reference points, i.e., "aspiration point" and "survival point" (Audia & Greve, 2006), or environmental and organizational moderator variables (Mone, McKinley, & Barker, 1998). Still others try to reconcile by calling our attention on different loci of influence derived from the negative domain perception, i.e., risk preference's absolute level and sensitivity (Greve, 1998).

These efforts have shown the prospect theory and the threat rigidity perspectives are complementary. Since prospect framing has more direct and explicit effects on risk preference (Greve, 1998; Lant, Milliken, & Batra, 1992), and the effects of threat rigidity could be considered as identical to survival point's effects, we develop our deduction on the assumption that the understanding that adversarial situation promotes more risk taking at organizations is firmly established.

Organizational learning and risk preference

In this section, we consider behavioral consequences of exploitative learning and of explorative learning on managers' risk preference. We deduce them by adopting a contingency perspective that distinguishes consequences from these two polar organizational learning processes, i.e., the case in the stable competitive environments and the unstable competitive environments are considered separately. This comparative analysis framework is quite common and established in the study of organizational risk behaviors (Lant, Milliken, & Batra, 1992; Miller & Chen, 1994). Specifically, we focus our argument on three related, but conceptually distinct aspects of behavioral consequences. They are impacts on performance, resources, and prospect framing.

Table 1 summarizes the results of our deduction. Three columns in the middle show

partial effects derived from each risk preference antecedent. The right end column shows overall risk preference consequences, gained by combining three partial effects. Some cells contain two different deduction results depending on whether antecedent values are extreme or not. Specifically, effects of minor to moderate level of antecedents are shown without parentheses, while those of extreme levels are shown in parentheses. We also highlight our main deductions with shades for all cells.

Table 1

	Attainment discrepancy	**Organizational slack**	**Prospect framing**	**Consequential risk-preference**
Exploitative learning				
Stable competitive environments	Neutral	Risk-seeking (Risk-averse)	Neutral (Risk-averse)	Risk-seeking (risk-averse)
Unstable competitive environments	Neutral	Risk-averse	Neutral (Risk-seeking)	Risk-averse (Inconclusive)
Explorative learning				
Stable competitive environments	Risk-seeking (Risk-averse)	Risk-averse	Neutral	Inconclusive (Risk-averse)
Unstable competitive environments	Risk-averse	Risk-seeking (Risk-averse)	Neutral	Inconclusive (Risk-averse)

Exploitative learning and antecedents of risk preference

In the preceding section, we discussed three distinct antecedents for risk-seeking behaviors. They are attainment discrepancy, organizational slack, and prospect framing. In this section, we consider how these antecedents are affected by preceding organizational learning. Specifically, we consider how managers' risk preferences are affected as they repeat exploitative learning.

Exploitative learning in the stable competitive environments: In the stable competitive environments, exploitative learning is expected to promote risk-seeking behaviors up to a certain level. Exploitative learning under the stable competitive environments generally assures favorable performance outcome (Burns & Stalker, 1961; Jansen, Van Den Bosch & Volberda, 2006; Lawrence & Lorsch, 1967; Wang & Li, 2008). More specifically, the performance level is likely to be above the preceding aspiration level. Under the stable competitive environments, which are characterized by the lack of qualitative changes in demand distribution, competition evolves along efficiency

improvements (Péli, 2009). This is because efficiency improvements provide various benefits required for the competition in the stable competitive environments.

For example, managers could achieve substantial cost reductions by accumulating exploitative learning (Hollander, 1965). Also, by repetition and incremental refinements, managers are able to establish idiosyncratic organizational routines, and thus unique organizational capabilities (Adler et al., 2009; Nelson & Winter, 1982). In addition, exploitative learning is an important source of reliability and accountability. High reliability and accountability enable favorable performance and organizational longevity, since various external stakeholders, including suppliers, distributors, alliance partners, governments, and local communities, select those organizations with high reliability and accountability over less reliable and accountable ones (Hannan & Freeman, 1984).

All these arguments indicate exploitatively learning organizations are likely to enjoy positive attainment discrepancies. However, the effect of over-performance on risk preference adjustment should be limited. This is because exploitation is mean-enhancing (Benner & Tushman, 2002; McGrath, 2001), and thus, the magnitude of over-performance is rather limited, which is quickly resolved by an upward adjustment of the aspiration level.

On the other hand, favorable performance leads to a gradual increase in organizational resources, thus increased organizational slack (Cyert & March, 1963). Increased organizational slack promotes risk-seeking behaviors until the level of slack gets excessive. As is discusses above, once the amount of organizational slack grows excessive, we expect a drastic change in managers' risk preferences. They, then, behave in more risk-averse manners due to the lack of disciplines.

The effect of prospect framing is also dependent on how favorable the performance is, i.e., the extent to which managers experience prior gains. While the amount of prior gains is minor or moderate relative to the focal prospect, we expect the effect of prospect framing is quite neutral. Thus, previous gains do not affect managers' risk preference, which is mainly affected toward a risk-seeking direction by an increased amount of organizational slack. One unique aspect of exploitative learning under the stable competitive environments is that previous gains are perceived as continuous, because exploitative mode of organizational learning emphasizes the continuity of managers' perceptual frame (March, 1991, McGrath, 2001). As incremental gains are perceived over long periods, managers might form a substantially major domain of gains, enhancing their level of risk-averseness. This effect seems to be consistent with that of excessive organizational slack, i.e., managers

behave in more risk-averse manners.

Therefore, we may expect a curvilinear (inverted U-shape) relationship between managers' risk-seeking behaviors and the extent to which exploitative organizations maintain favorable performance under the stable competitive environments. Managers behave in risk-seeking manners when their organizations are moderately successful, while they grow more risk-averse as their level of success passes certain threshold. However, since we are not sure whether the thresholds for organizational slack and prior gains are identical or not, we feel we should limit our major deduction to the case when both organizational slack and prior gains are minor to moderate. Managers are expected to behave in risk-seeking manners under these conditions, because the accumulation of organizational slack allows them to try unproven approaches, while prior gains are too limited to affect prospects.

Exploitative learning in the unstable competitive environments: In the unstable competitive environments, we deduce that exploitative learning promotes managers' risk-averse behaviors up to a certain level. Exploitative learning under the unstable competitive environments deteriorates organization's adaptive capability. It is because exploitative managers place too much emphasis on refining and modifying existing processes or technologies, even when more advanced process or technologies are available thanks to a shift in competitive environments (Levitt & March, 1988). More serious drawbacks with exploitative learning in the unstable competitive environments are that existing expertise could turn into a weakness due to changes in competitive requirements (Leonard-Barton, 1992). Even when the nature of changes are not so hostile, exploitative learning is inherently self-affirming its underlying perceptual frame (Kiesler & Sproull, 1982; Weick, 1979), so exploitative managers should find it more difficult to recognize drastic (i.e., disproving) environmental changes (Kaplan, Murray, & Henderson, 2003; Tripsas & Gavetti, 2000).

Consequently managers suffer from under-performance relative to their aspiration levels, but the pressure on risk-seeking behaviors should be limited mainly due to small discrepancies and continuous downward adjustment on the aspiration levels.

On the other hand, deteriorated performance erodes organizational slack (Cyert & March, 1963), forcing managers to follow risk-averse behaviors. The risk-averseness should not be countered by risk-seeking tendency caused by previous losses until the magnitude of accumulated previous losses gets substantial enough relative to the focal

prospect. However, we presume risk-averseness is rarely outweighed in the case of unstable competitive environments. It is because relatively shorter periods are perceived as continuous due to the changing characteristics of competitive landscape. Thus, in this case, managers are likely to show more risk-averseness as they keep learning in exploitative manner, although its impact would be diminishing as more losses accumulate.

Explorative learning and antecedents of risk preference

We deduced that exploitative organizational learning's risk preference consequences are different depending on the level of competitive environments' stability. In this section we consider how managers' risk preferences are affected when organizational learning is more explorative.

Explorative learning in the stable competitive environments: In the stable competitive environments, we deduce that explorative learning promotes managers' risk-averse behaviors. Explorative learning under the stable competitive environments generally deteriorates organizational performance, because managers waste valuable opportunities to gain the fruit of specialization and efficiency (Aldrich, 1999; Anderson & Tushman, 2001; Smith & Tushman, 2005). Such over-experiment or over-search is detrimental in itself, because changes are inherently costly, and sometimes can be fatal to organizations (Barnett & Carroll, 1995). In addition, the impact of under-performance is too significant to be resolved only by adjustments on the aspiration level, because exploration is variance-enhancing (Benner & Tushman, 2002; McGrath, 2001). These arguments might indicate managers to be more risk-seeking due to a negative attainment discrepancy when they accumulate explorative learning under the stable competitive environments.

However, since explorative learning is generally associated with such substantial resource deployments as M&A, new product launch, or foreign expansion, unsuccessful consequences from these initiatives are more likely to be grave. As a result, the magnitude of the negative attainment discrepancy is expected to be rather substantial as to managers feel they are too close to the survival point, where they behave in more risk-averse manners (Audia & Greve, 2006; March & Shapira, 1987).

Managers' risk-averse behaviors are also reinforced by the effects of reduced organizational slack resulting from unfavorable performance (Cyert & March, 1963). Unsuccessfully exploring managers suffer from erosion of their resources, and decreased

organizational slack promotes managers' risk-averse behaviors. Put differently, managers are expected to behave in more risk-averse manners because the effect of very negative attainment discrepancy and decreased organizational slack pushes them toward more conservative approaches.

This deduction is not affected by bringing the effect of prospect framing into the equation. Specifically, the effect of prospect framing is expected to be neutral. It is because explorative learning requires a drastic departure from existing perceptual frame, as is indicated by the call for the structural separation (Christensen & Bower, 1996; Cooper & Smith, 1992; Gilbert, 2005) or executive changes (Hedberg, 1981; Nystrom & Starbuck, 1984; Starbuck, Greve & Hedberg, 1978). Consequently, previous losses should play no substantial roles no matter how significant they are.

Therefore, in rare cases of moderately negative attainment discrepancy, our deduction might be inconclusive because the risk preference consequence depends on relative magnitudes of risk-averse and risk-seeking behaviors. However, considering the nature of explorative learning, more general deduction should be that explorative learning is expected to promote risk-averse behaviors in the stable competitive environments because managers feel their survival point is too close and their organizational slack is too limited for risk taking.

Explorative learning in the unstable competitive environments: In the unstable competitive environment, we deduce that explorative learning promotes risk-averse behaviors too. Due to its variance-enhancing nature (Benner & Tushman, 2002; McGrath, 2001), explorative learning under the unstable competitive environments is more likely to result in a favorable organizational performance. The unstable competitive environment is characterized by qualitative changes in the demand distribution. Under these changes, those organizations that successfully search for the best adaptive fit to the new competitive environment will out-compete others with inferior fit (Péli, 2009). As a result, the competition evolves along broader scans on the solution space. Alternatively, with exploration-based search strategies, managers can more easily be engaged in inter-organizational knowledge exchanges to gain an access to more diverse knowledge (Arikan, 2009).

Another consequence of explorative learning's variance-enhancing nature is a significant variability in the distribution of learning results. Therefore, favorable results of explorative learning are likely to be substantial, i.e., a significantly positive attainment discrepancy.

Therefore, risk preference can not be perfectly adjusted since the magnitude of discrepancies between performance level and aspiration level is too large. The significantly positive attainment discrepancy affects managers to be more risk-averse in exploring organizations under unstable competitive environments.

On the other hand, the effect of explorative learning on the level of organizational slack is quite consistent with that of positive attainment discrepancy. As was discussed in the case of stable competitive environments, the magnitude of successful exploration's effects on organizational resource accumulation is rather significant in a positive direction. It is because explorative managers are willing to take greater risk when they deploy resources, and greater risk taking is generally compensated with greater returns. Managers might behave in more risk-seeking manners when their organizational slack is limited to the moderate level, since it allows the luxury of toying with unproven ideas and approaches. However, more likely case for the exploring organizations in the unstable competitive environments should be a rather substantial accumulation of organizational slack, which indulges managers to stay on the proven course.

On the other hand, the effect of prospect framing is neutral. It is because exploration requires a drastic departure from existing perceptual frame. Managers perceive previous gains and the focal prospect separately, so there can not be any meaningful effects on their risk preferences.

Therefore, in rare cases of moderately successful organizations, our deduction should be inconclusive because the risk preference consequence depends on relative magnitudes of risk-averse and risk-seeking behaviors. More specifically, Risk-seeking behaviors derived from excess organizational resources and risk-averse behaviors derived from positive attainment discrepancy contradict each other, making conclusive deduction difficult. However, considering the nature of explorative learning, the behavioral consequence seems to be more definite in the case of exploring organizations under unstable competitive environments, since more general deduction should be that explorative learning is expected to promote risk-averse behaviors for managers in these organizations. It is because managers feel they are doing too well and too resourceful so they should not change anything by acting in risk-taking manners.

Discussion and implications

The initial question we raised at the beginning of this paper is how organizational learning affects ensuing risk preferences. In the case of exploitation, we reasoned the result should be different depending on the level of stability in the competitive environments. More specifically, exploitative learning facilitates more risk-seeking behaviors in stable competitive environments, while more risk-averse behaviors result in unstable competitive environments. On the other hand, our deduction on the effect of explorative learning is consistent across different levels of environmental stability. Explorative learning facilitates risk-averse behaviors irrespective of competitive environment's stability.

One of the interesting findings of ours is that the risk preference consequences of preceding organizational learning are predominantly (i.e., three out of four cases) risk-averse. In other words, as managers accumulate more and more learning, they generally grow more risk-averse no matter what type of organizational learning they accumulate. This deduction sounds quite consistent with those who argue for the negative effect of organizational aging on innovative capability (Sorensen & Stuart, 2000), or even on organizational mortality, i.e., liabilities of senescence and obsolescence (Hannan, 1998).

A notable exception for this overall finding is the case of exploitative learning in the stable competitive environments. This finding is noteworthy in that it contradicts the established perspective that exploitation crowds out exploration (Levinthal & March, 1981; March, 1991). The underlying assumption of the established perspective is that managers are inherently risk-averse. As a boundedly rational actor, managers are said to be more comfortable in expecting more certain and short-term returns, even though they are forced to leave significant profit opportunities on the table for the fear of these opportunities' less certain and longer-term nature (March, 1991). We do not argue against the assumption on inherent nature of managers (or human being in general). However, this established perspective should be valid under the same usual qualification, i.e., "other things being equal," and we argue the "other things" are actually quite important.

We might as well question why we do not more frequently observe explorative learning triggered by exploitative learning, in spite of our deduction that exploitative learning in stable environments promotes risk-seeking behaviors. One obvious reason is that unless we employ a perspective contingent upon competitive environments' stability, risk preference consequence of exploitative learning is bound to be inconclusive.

However, there seems to be a more fundamental reason for the gap between the general observation and the result of our deduction. More specifically, the gap indicates that managers need more than risk-seeking behaviors for successful exploratory learning. As March & Shapira (1987) indicates, "(t) he idea of risk taking in the face of adversity certainly finds support, but the idea that major innovations and change are produced by misery is not well-supported by history (p. 1406)." Obviously, managers need to have a novel good idea in addition to risk-seeking attitude in order to successfully explore. In other words, explorative learning requires not only behavioral, or procedural antecedent (i.e., risk-seeking behaviors), but also content antecedent (i.e., novel knowledge).

Our deduction is one of the first trials to show organizational learning's effects on the first of these two complementary antecedents for the exploratory learning (i.e., risk-seeking and novel idea). As for the second one, the positive association between exploitative learning and generation of novel knowledge has been empirically shown. For example, scholars show experiments under established regime or tightly controlled search are effective for adaptations to new contexts (Ahuja & Lampert, 2001; Leonard-Barton, Bowen, Clark, Holloway, & Wheelwright, 1994; Lynn, Morone & Paulson, 1996). Therefore the difficulty in simultaneously realizing these complementary antecedents, or the interaction between them, should be an interesting research topic to be pursued in the future.

On the other hand, our deduction on risk preference consequences in the case of exploring organizations is also of theoretical interests. More specifically, we add a new *process*-centric perspective to a more *contents*-centric explanation on why exploration leads to ensuing exploitation (Barnett & Carroll, 1995). Our general understanding presumes exploration is followed by exploitation, because exploration primes contents to be further exploited. In other words, exploring organizations are endowed the opportunity for succeeding exploitation, since the *contents* of exploration, i.e., a newly found and less matured knowledge domain gained as a result of explorative learning provides the foundation of succeeding exploitation.

In addition to this contents-centric explanation, we argue for more process-centric explanation on why exploration is succeeded by exploitation. Namely, exploration is followed by exploitation because managers grow more risk-averse as they accumulate explorative learning. Our deduction that managers grow more risk-averse as a result of explorative organizational learning is purely process-centric, because it is valid irrespective of the type of exploratory learned contents. Thus, we feel our arguments contribute to the

literature of organizational learning by showing the validity of discussing the *contents* aspect and the *process* aspect separately in the field of knowledge accumulation and organizational evolution.

We also aspire to make another contribution by tying traditionally discrete streams of theories into a unified theoretical framework. The argument on attainment discrepancy is originally related to the mechanisms of organizational learning (Cyert & March, 1963; March & Simon, 1958), and has been developed into quite discrete disciplines of organizational risk taking. Theories of organizational slack put more emphasis on a tangible existence of organizational resources, rather than intangible cognitive elements. Prospect theory is appreciated and developed mostly in the discipline of finance. We tied these distinct theories into a unified theoretical framework in order to better explain organization's learning behaviors from a more holistic perspective.

Our argument also provides a critical complementary component for the argument on the dynamics of cyclical organizational learning (Crossan, Lane, & White, 1999; Nooteboom, 2000; Zollo & Winter, 2002). The perspective that sees organizational learning as cyclical is distinct from a more established dichotomous perspective, and as such retains a potential to be developed into a renewed understanding on organizational learning. Especially, they provide a novel perspective arguing that exploitation prepares and enables exploration. However, the research is still too under-developed, and we need much more work before realizing this potential.

For example, Norteboom and his colleagues propose the dialectic process of exploitation and exploration, which they call "the cycle of discovery (Gilsing & Nooteboom, 2006; Nooteboom, 2000)." Their argument is noteworthy because in addition to the more widely understood organizational learning cycle which runs from exploration to exploitation, they showed exploitation also leads to exploration by way of "differentiation" and "reciprocation." However, it was left to be explained by future research why organizations are motivated to try different contexts ("differentiation") or to exchang knowledge and to learn among different contexts ("reciprocation"). The motivational aspect is of the critical importance because scholars have described managers' difficulties in explorative endeavors are more closely related to challenges of overcoming internal resistance than to the lack of knowledge or capability (Christensen & Bower, 1996; Henderson & Clark, 1990; March, 1991 among others).

Zollo & Winter (2002) also argued replication of solutions or retention of knowledge in

diverse contexts "prime the initiation of a new knowledge cycle (p. 344)," in other words, that exploitation "primes" exploration. However, this cyclic dynamics have not been explained from the perspective of firms' motivation either.

By adopting a behavioral analytic perspective, we are able to explain why managers are motivated to succeed exploitative learning with explorative learning. In other words, exploitative learning under the stable competitive environments plays a significant role in enhancing managers' risk-seeking preferences, leading to higher willingness to try unproven profit opportunities.

Other streams of works on the cyclic dynamism of organizational learning focus on hierarchical organizational structure as a key ingredient of exploitation-exploration linkage (Adler et al., 2009; Crossan, Lane, & White, 1999; Crossan & Berdrow, 2003; Siggelkow & Levinthal, 2003; Siggelkow & Rivkin, 2006). We do not deny the possibility that the distributed nature of exploitations at lower level of organizational hierarchy sometimes stimulates explorations by managers at higher organizational hierarchy. However, organizational hierarchy is a notorious anathema for the creativity and flexibility. It should be fair to state that organizational hierarchy may positively moderate the relationship between exploitation and exploration in some cases, but not in others. Thus finding out the boundary conditions between these two polar consequences should still be a challenging agenda, to which we hope to have made some contributions in this paper.

The understanding on cyclical organizational learning is very important first step to address the drawback of excessively dichotomized theory (Parmigiani & Mitchell, 2009) on organizational learning. It also contains the potential of clarifying the mechanism how organizations exploitatively learn, and generate radically new innovation (Gilsing & Nooteboom, 2006; Lant, Milliken, & Batra, 1992; Nooteboom, 2000). We believe we have much more to research on the interplay between exploitation and exploration, and even more to gain from it.

Notes

1) Audia & Greve (2006) showed the low performance relative to the aspiration level reduces risk taking in small firms, while more risk seeking was observed in the case of large firms. They argue firms' stock of resources determine whether firms pay more attention to the aspiration level or the "survival point." This reasoning sounds more like the one on organizational slack. Also, their findings on the high performance relative to the aspiration level were largely insignificant, indicating their research design made effects of organizational slack more explicit

than those of performance relative to the aspiration level.

2) Miller & Chen (2004) employed the agency theory to explain their unexpected finding on the effect of bankruptcy. However, if they observed enhanced risk taking because managers play with the risk at the cost of shareholders, the same effect should be observed when risk is operationalized with managers' perceived risk, which is not the case.

3) One logical extension of this argument is that inherently risk-seeking decision makers (i.e., those who are under the *uncertainty* effect) behave in more risk-seeking manners when they find themselves in the domain of gains, as is shown in Osborn & Jackson (1988). Their finding is not directly applicable to managers in business organizations (since they are assumed to be inherently risk-averse), but it serves as an interesting theoretical replication (Yin, 1994) for the prospect theory.

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