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Abstract
We utilize the exploration/exploitation framework to examine how a firm's engagement in exploration influences its portfolio of external corporate venturing (ECV) activities. Three forms of equity-based ECV are considered: corporate venture capital investments, joint ventures, and acquisitions. The organizational learning literature is used to investigate how a firm's engagement in exploration influences its usage of acquisitions relative to its overall portfolio of ECV activities. The investing firm's industry technological dynamism is posited as a moderator of the relationship between exploration and the relative usage of acquisitions. Utilizing a sample of 1,326 firm-year observations between 1996 and 2008, we find that exploration is positively related to the relative usage of acquisitions, though this relationship is moderated by the investing firm's industry technological dynamism.

Keywords: corporate venturing, corporate venture capital, exploration, environment

The processes by which firms search for knowledge to renew their strategies and adapt to their environments are a central component of the strategic management and corporate entrepreneurship literatures (Uotila, Maula, Keil, & Zahra, 2009). The most widely recognized form of knowledge search was explicated by March (1991), who proposed that firms pursue learning either by exploiting current knowledge and "old certainties" or by engaging

in a more entrepreneurial process wherein new opportunities or knowledge domains are explored. Firms therefore engage in learning and knowledge search via processes of exploration or exploitation.

Established firms often form relationships with entrepreneurial ventures to engage in knowledge-search processes (Schildt, Maula, & Keil, 2005). This practice is referred to as external corporate venturing (ECV) and is defined as "[firm] investments that facilitate the founding and/or growth of external businesses" (Covin & Miles, 2007: 183). A central consideration for firms engaged in external venturing relates to what form of venturing to pursue. Indeed, there are numerous modes of investment through which established firms may engage in ECV, though the most common equity-based forms include the acquisition of entrepreneurial ventures, corporate venture capital (CVC) investments—defined as minority equity investments made by an established firm in an entrepreneurial venture (Dushnitsky & Lenox, 2005a)—and the formation of new joint ventures (JV) by two or more firms. In other words, firms face a decision either to fully commit requisite resources to the venture by acquiring it via the assumption of a majority equity position or to partially commit resources to the venture—via either investment (CVC) or by jointly forming the venture with another organization (JV).

Despite an increasingly robust literature for each individual mode of external venturing, research has only recently started to investigate factors that influence choices among the external venturing modes and tends to utilize the real-options literature to focus on issues relating to uncertainty (Tong & Li, 2011; van de Vrande, Vanhaverbeke, & Duysters, 2009). Though the extant ECV mode-choice literature has generated many useful insights pertaining to when firms commit resources to ventures in the face of uncertainty, important knowledge gaps persist. Specifically, prior work *implies* how exploratory search processes influence venturing behaviors, but there has been no *direct* theorizing or testing of the relationship between search processes and ECV activity. Specifically, extant research emphasizes the exploratory outcomes of external venturing (e.g., Schildt et al., 2005; Wadhwa & Kotha, 2006) but does not examine the exploratory motivations for external venturing activities. The lack of direct theorizing and testing has led to competing implications regarding how exploratory learning influences venturing behaviors. Some research suggests firms engaged in exploration are more likely to minimally invest their resources in the venture, which allows investing firms to create multiple flexible and reversible exploratory "options" that can be exercised at a future date for exploitative purposes, particularly in highly uncertain environments (Folta, 1998; Tong & Li, 2011). Other research, however, suggests that strong resource investments signal the parent's commitment to the venture, thereby facilitating exploratory learning processes (Wadhwa & Basu, 2013).

These contrasting propositions highlight a gap in the literature. Despite the frequent acknowledgement that ECV activity is employed for exploratory learning purposes (see, for example, Cui & Kumar, 2012; Phene, Tallman, & Almeida, 2012; Wadhwa & Kotha, 2006), we know little regarding how a firm's tendency to engage in exploration influences its external venturing mode decisions. The significance of this knowledge gap is notable because many firms explicitly state that learning objectives relating to novel technologies and opportunities, and not necessarily transactional efficiencies, are at the core of their venturing efforts (Dushnitsky & Lenox, 2005b). However, the untested assumption that exploration drives all ECV activities paints an inaccurate picture of how exploratory learning actually drives firm ECV behavior.

The purpose of this article is to address this knowledge gap by exploring the following research questions. Does a firm's engagement in exploration influence its usage of acquisitions relative to its total external venturing activities? In other words, does exploration influence a firm's portfolio of external venturing activities? Research on this question may help clarify, for example, whether an emphasis on exploration is characteristically realized through spreading investments across multiple external venturing opportunities (the partial commitment option, as discussed above) or concentrating investments in fewer or more resource-consuming opportunities (the full commitment option, as discussed above). Either option may be chosen to enact exploration, but how do firms balance these options as a function of the degree to which they emphasize exploration?

A second question addressed by this research is, does the technological dynamism faced by the investing firm moderate the relationship between exploration and ECV activity? This research question is motivated by the recognition that environmental exigencies play a crucial role in understanding how firms engage in and manifest their learning processes (Levinthal & March, 1993; Uotila et al., 2009) and make decisions relating to the extent to which a firm commits in its external venturing activities (Folta, 1998). Notably, environmental uncertainty, as represented here by technological dynamism, is recognized by transaction costs theory (Williamson, 1975)—a theoretical lens herein employed to predict the relationships examined—as a principal determinant of whether firms internalize or externalize their transactions, of which ECV modes would be one form. Weber and Mayer (2014) note the importance of examining specific forms of environmental uncertainty, such as technological uncertainty—which we refer to as technological dynamism—when utilizing the transaction-costs economics (TCE) literature to study governance mode decisions. We explore the possibility that technological dynamism may enhance or attenuate the effects of exploration on particular ECV mode choices.

We build on prior external venturing and organizational learning literatures by investigating how learning drives ECV activity. We posit that exploration is positively related to the relative usage of acquisitions, because acquisitions are directly related to the absorption and subsequent usage of the target firm's knowledge base and facilitate the timely execution of learning objectives (Ahuja & Katila, 2001). However, we also suggest that industry technological dynamism mitigates the attractiveness of acquisitions for firms engaged in exploration due to difficulties inherent in valuating investments in uncertain environments (Balakrishnan & Koza, 1993).

This article makes several contributions to the corporate venturing and organizational learning literatures. First, we contribute to the ECV literature by going beyond demonstrating that exploration drives single external venturing activities to demonstrating that exploration drives the balance of ECV mode choices. By exploring this issue directly, we facilitate future research on the interrelatedness of external venturing activities and partially answer the call to increase scholarship relating to examining multiple modes of external venturing concurrently (Tong & Li, 2011). Second, we contribute to the growing stream of research that recognizes that firms engage in multiple forms of venturing with multiple partners, which highlights the importance of considering external venturing activities as a portfolio rather than individual activities (van de Vrande, 2013). Finally, we contribute to the organizational learning literature by contextually situating a firm's learning orientation, thereby facilitating the development of "boundary conditions" for the ubiquitous exploration/exploitation perspective (Danneels & Sethi, 2011). Specifically, we complement the exploration/exploitation

perspective with insights derived from TCE to examine how technological dynamism influences the ECV mode choices of firms with variously strong biases toward exploration.

Hypotheses Development

External Corporate Venturing

The ECV literature has grown significantly over the past decade. Though many studies focus on one particular mode of venturing in isolation of others, there is a growing stream that considers multiple modes concurrently. Notably, the specific modes of venturing examined vary by study: acquisitions and CVC investments (Tong & Li, 2011); CVC investments and nonequity strategic alliances (Dushnitsky & Lavie, 2010; van de Vrande & Vanhaverbeke, 2013); CVC investments, nonequity alliances, JVs, and acquisitions (Keil, Maula, Schildt, & Zahra, 2008); and so on. Given the variety of modes considered, the selection of which modes to include in a study needs to be carefully considered. For the purposes of our research questions—that is, when a firm fully commits to a venture via an acquisition (assuming majority ownership) compared to partially committing (assuming partial ownership), either through a CVC investment or by jointly forming a new venture with another firm—the commitment of equity is central. In other words, the presence of ownership of the venture is a central consideration for our research. We therefore focus only on equity-based forms of external venturing and do not include nonequity alliances.

In our research model, we hypothesize the influence of exploration on the relative usage of acquisitions, that is, the extent to which acquisitions are utilized in relation to a firm's total engagement in equity-based venturing. We focus on acquisitions because they represent "full commitment" to the venture—an unambiguous contrast to CVC investments or JVs. While CVC investments and JVs entail the assumption of equity in a venture, both have also been characterized as "options" that allow the investing firm to defer complete commitment until, for example, uncertainty surrounding the venture is sufficiently resolved (Folta, 1998; Tong & Li, 2011). As noted by Tong and Li (2011: 661), "it is much more difficult to (acquire and then) divest a company than to liquidate a minority equity stake." Indeed, though JVs are typically thought of as representing more commitment than CVC investments, the commitment from the corporate parent remains "shared" in both instances, unlike the case with acquisitions.

The Relationship Between Exploration and ECV Mode

The exploration/exploitation framework has been extensively utilized in past research on knowledge development and application (Bierly, Damanpour, & Santoro, 2009) and is a common lens through which external venturing activities are examined (Basu & Wadhwa, 2013; Schildt et al., 2005). However, there is significant disagreement regarding specific facets of the exploration/exploitation framework. Some argue that exploration and exploitation are orthogonal processes that may occur simultaneously, while others argue that the two forms of learning are anchors on a continuum such that firms have a relative focus on either exploration or exploitation (Gupta, Smith, & Shalley, 2006).

Nevertheless, it is important to note that there is general consensus on certain key points. First, exploitative activities are associated with local search processes, while exploratory

activities are associated with distant search processes (Levinthal & March, 1981). In other words, exploratory activities are utilized to alter a firm's technological trajectory or broaden its knowledge base, while exploitative activities leverage or build upon a firm's existing technological or knowledge base (Phene et al., 2012). Second, there is inherent tension between the two activities, particularly given limited resources to expend and limited opportunities to pursue (March, 1991). Finally, firms must pursue both processes to facilitate survival, and overengagement in one can be detrimental to a firm (Wang & Li, 2008). For the purposes of our research questions, we conceptualize and model exploration and exploitation as learning processes that can occur concurrently.

Though exploiting current knowledge bases and resources may motivate venturing activities (Phene et al., 2012), the corporate venturing literature tends to emphasize the exploratory learning objectives associated with external venturing activities (Foss, Lyngsie, & Zahra, 2013; Hill & Birkinshaw, in press). For example, external venturing serves as a means to alter or broaden the investing firm's (also referred to as the parent firm) technological trajectory or to learn about novel and distant opportunities (Basu & Wadhwa, 2013; Keil, 2004). Exploration is proposed to influence CVC investments (Wadhwa & Basu, 2013), JVs (Cui & Kumar, 2012), and acquisitions (Phene et al., 2012). Extant research indicates that forms of external venturing that entail lower levels of commitment are more strongly linked to exploratory learning (Schildt et al., 2005) and the creation of pioneering technologies (van de Vrande, Vanhaverbeke, & Duysters, 2011) than forms with higher levels of commitment. However, we posit that firms more strongly engaged in exploration will utilize acquisitions more frequently in their ECV portfolio than other firms. There are two major reasons why this is the case: commitment and control.

Within the context of CVC investments, Wadhwa and Basu (2013) suggest and find that external venturing characterized by high levels of exploration tend to entail greater resource commitment from the parent to the venture than external venturing characterized by moderate levels of exploration. The authors propose that the greater commitment exhibited by a parent organization that invests more resources facilitates knowledge sharing between the venture and the parent firm. Similarly, we propose that firms engaged in exploration will signal their commitment to ventures by engaging in more acquisitions (relative to their external venturing portfolio) than firms exhibiting lower levels of exploration. The commitment signaled to the external venture due to the acquisition will also encourage the development of openness between the investing firm and the venture, which is a critical element in the transfer of knowledge from one firm to another (Inkpen, 2000).

Second, acquisitions give the parent firm greater control over ventures than do CVC investments or JVs. Phene et al. (2012) found that greater levels of control by the acquiring firm over the acquisition target facilitates exploratory learning—contrary to the hypothesis that greater target firm autonomy would facilitate more exploratory learning. The finding that control facilitates exploratory learning resonates with the proposition that close social interaction facilitates the sharing of knowledge (Kogut & Zander, 1992). Further, as noted by Grant (1996: 114), "*transferring* knowledge is not an efficient approach to *integrating* knowledge." Directly acquiring an external venture will put the acquiring firm in direct control of what knowledge it will graft into its corporate body (Huber, 1991).

Due to the level of commitment to a venture and control of the venture, we posit that firms engaged in exploration tend to acquire more frequently, relative to their overall

external venturing activities, than firms with lower levels of exploration. We therefore hypothesize the following:

> ***Hypothesis 1:*** There is a positive relationship between the degree of exploration and the relative usage of acquisitions within the portfolio of equity-based ECV investments.

The Moderating Role of Technological Dynamism

Industries with high levels of R&D intensity characteristically exhibit technological dynamism (Uotila et al., 2009), manifested through frequent changes in technological norms and high resource demands focused on developing new technologies. In such industries, firms face uncertainty regarding what knowledge, capabilities, actors, and resources will prove most beneficial (Grant, 1996; Miller, 1979). Due to the importance of uncertainty to learning-related outcomes, technological dynamism plays a critical role in the organizational learning literature. Frequent changes in technological demands exert pressure on incumbent firms to actively innovate and explore new technological opportunities and can increase the risks associated with exploiting current knowledge rather than exploring for new knowledge (Sahaym, Steensma, & Barden, 2010). As such, the risks associated with "sticking with what you know" are elevated in such contexts (Uotila et al., 2009). Conversely, technologically stable industries are easier to predict and enable mangers to "stick with what they know" due to a lack of pressure to update decision-making paradigms (Wu, Levitas, & Priem, 2005).

The TCE literature provides insight regarding the influence of technological dynamism on a firm's portfolio of ECV activities. When parent firms face high levels of environmental uncertainty, they are more likely to engage in arm's-length organizational modes rather than hierarchical modes (Leiblein & Miller, 2003; Tong & Li, 2011; van de Vrande et al., 2009). Folta (1998) indicates that the cost of commitment in technologically uncertain environments—for example, commitment to a particular technology or knowledge base—may offset the savings in administrative costs offered by integrated modes. As noted by Leiblein and Miller (2003), uncertainty hinders a firm's ability to forecast the value contribution of any particular activity, which makes high-commitment activities less attractive.

Notably, different forms of uncertainty exert distinct pressures on governance mode selection (Weber & Mayer, 2014). For example, Santoro and McGill (2005) found that partner- or task-specific uncertainty increases the likelihood of hierarchical governance modes, while technological uncertainty decreases the likelihood of hierarchal governance modes. Flexibility in governance mode decisions is especially salient in the case of technological uncertainty due to the potential for technological obsolescence (Balakrishnan & Wernerfelt, 1986). Firms are therefore less likely to integrate an external business under conditions of technological uncertainty because doing so entails extensive resource commitment that is difficult and costly to reverse.

Basu, Phelps, and Kotha (2011) found that firms in technologically intensive industries tend to make more CVC investments than firms in less technologically intensive industries. Similarly, Tong and Li (2011) found that firms are more likely to engage in CVC investments rather than acquisitions when technological uncertainty is high. These previously established direct effect relationships between uncertainty and external venturing mode suggest that technological uncertainty exerts an attenuating influence on the relationship

between exploration and the relative usage of acquisitions. Though firms strongly engaged in exploration may utilize acquisitions more frequently than firms less strongly engaged in exploration, we posit that technological dynamism negatively affects this relationship such that the relative use of acquisitions diminishes. The inherently unfamiliar and high-risk nature of exploratory investments in technologically dynamic industries makes it difficult for the corporate parent to accurately evaluate relevant knowledge and assets, diminishing the incentive to acquire a venture (Balakrishnan & Koza, 1993). Firms engaged in exploration may therefore rely more heavily on forms of external venturing that require lower levels of commitment, that is, CVC investments or JVs.

Indeed, the predominant logic in ECV research suggests that CVC investments allow investing firms to experiment with new capabilities and resources via the entrepreneurial venture to develop an understanding of future capability needs via "disembodied experimentation" (Keil, Autio, & George, 2008). More recently, research has found that CVC investments may be a monitoring mechanism that directs a top management team's attention to technological discontinuities (Maula, Keil, & Zahra, 2013). Additionally, technology-focused JVs tend to form in industries with high levels of technological uncertainty (Estrada, de la Fuente, & Martín-Cruz, 2010). Though JVs have traditionally been thought of as exploitative in nature (Koza & Lewin, 1998), more recent research on the technologically intensive international pharmaceutical industry found that JV activities can lead to the introduction of highly innovative product breakthroughs (Dunlap-Hinkler, Kotabe, & Mudambi, 2010). We therefore hypothesize the following:

> ***Hypothesis 2:*** The higher the level of industry R&D intensity, the weaker the positive relationship between the degree of exploration and the relative usage of acquisitions within the portfolio of equity-based ECV investments.

Methods

Sample

The sample for this study is comprised of publicly traded U.S. firms venturing within the United States and engaged in acquisitions, the creation of JVs, or CVC investments between 1996 and 2008 in three broadly defined industries: information and communication technologies (ICT), chemicals, and medical and laboratory equipment. The three-digit Standard Industrial Classification (SIC) codes for these industries are as follows: ICT, 357, 366, 367, 737; chemicals, 281, 282, 283, 286, 287, 289; medical and laboratory equipment, 384, 382. The sample was restricted to public U.S. firms due to data availability and because venturing may entail different motivations in the international context (Winters & Murfin, 1988). The industries were selected due to the ubiquity of ECV activities, providing an appropriate sample in which to study ECV mode choice, and because their diverse nature provides variation on our industry-level construct. Accounting for missing data on key constructs, we determine that the total resulting sample is an unbalanced panel of 607 distinct firms and 1,326 firm-year observations. The mean and standard deviation for the parent firms' net sales (in millions) are $9,227.10 and $20,976.67, for employees (in thousands) are 24.09 and 46.47, and for net income (in millions) are $827.48 and $2,495.55. Figure 1 illustrates the total usage of each external venturing mode in our sample per year.

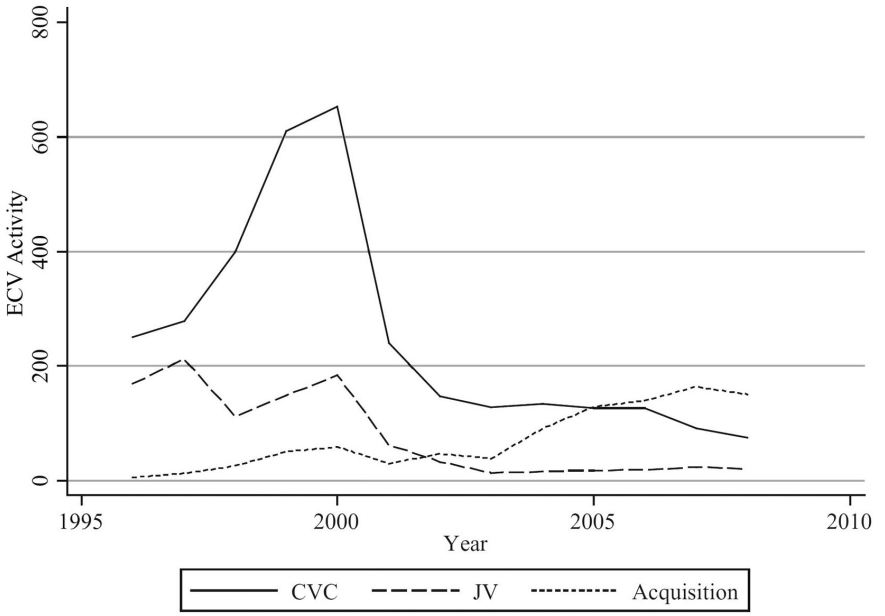

Figure 1. Total Yearly External Corporate Venturing Activity. CVC = corporate venture capital; ECV = external corporate venturing; JV = joint venture.

Data Sources

Data for this study were collected from several different sources. Data on venturing activities were drawn from Thompson Financial's Securities Data Company (SDC) Platinum and VentureXpert databases. SDC Platinum contains data on acquisitions and alliances, and VentureXpert contains information on CVC investments. The COMPUSTAT North American Fundamentals Annual database was used for financial data of parent companies and for the industry technological dynamism variable. Data were also collected from 10-K reports, which all publicly traded firms in the United States must file with the Securities and Exchange Commission.

Dependent Variable (DV): Relative Use of Acquisitions

Our research questions relate to why a firm engages in acquisitions relative to other equity-based forms of external venturing. As such, our DV is a firm's usage of acquisitions relative to its overall external venturing activities, which also includes CVC investments or the formation of new JVs. Though prior work on ECV may also include nonequity alliances (Keil, Maula, et al., 2008; van de Vrande et al., 2009), we do not incorporate them into our study because we chose to focus exclusively on equity-related investments. Specifically, our research questions focus on why firms may partially commit to a venture (i.e., CVC investment or JV creation) as compared to fully committing to a venture (outright acquisition). In other words, we are interested in external venturing that involves equity investments

rather than tie formation per se between two organizations. Notably, external venturing acquisitions are distinct from traditional M&A activity as ECV concerns the acquisition of young ventures by corporate parents rather than the acquisition of established firms (Benson & Ziedonis, 2009). As such, targets for acquisitions are restricted to firms that are 10 years old or younger at the time of acquisition, consistent with research on start-up ventures (Yli Renko, Autio, & Sapienza, 2001).

We calculate our DV by taking the total number of times firm *i* engaged in young venture acquisition in year *t*, adding 1 to that number, and then dividing that by the summation of 1 plus each mode of ECV activity for firm *i* in year *t*. For example, if firm *i* in year *t* acquired two ventures, created one JV, and made five CVC investments, then the relative use of acquisitions would equal $(2+1)/[(2+1)+(1+1)+(5+1)] = 3/11 = 0.27$. Adding 1 to each mode does not change the meaning of the relationships exhibited in a firm's portfolio of ECV activity; instead, it acts as transformation to improve the normal distribution of the variable (Wiseman, 2009).

Independent Variables

Exploration — Exploration has been measured in numerous ways, including patent search scope and depth (Katila & Ahuja, 2002; Schildt et al., 2005), the extent to which the search process is both technologically and organizationally boundary spanning (Rosenkopf & Nerkar, 2001), and the importance of explorative and exploitative objectives to the organization (He & Wong, 2004). Our operationalization of exploration follows a method utilized by Uotila et al. (2009) and is similar to the work of Vagnani (in press). We examine the degree of exploration expressed by the parent firm as assessed by its 10-K report. Specifically, we use computer-aided text analysis (CATA) of firm 10-K reports for each year in the sample. The 10-K reports contain discussion and analysis sections from the management of the company where information regarding firm traits, as expressed by management, can be gleaned. This analysis is therefore the degree of exploration expressed by the firm for all of its operations in a given year. Annual reports are considered an appropriate source of content analysis data, particularly in regard to a firm's strategic posture or characteristics (Short & Palmer, 2008), and have been used in the accounting (Neu, Warsame, & Pedwell, 1998) and business communication (Subramanian, Insley, & Blackwell, 1993) literatures. (For a more detailed discussion on the appropriateness of annual reports in content analysis, see Bowman, 1984.)

Each 10-K report was processed through the CATA software program DICTION. DICTION compares word usage in the text to the dictionary of interest. Word count scores are calculated and assigned on the basis of the word search. The dictionary utilized to calculate exploration comes from March's (1991: 71) description of exploration, including "things captured by terms such as search, variation, risk taking, experimentation, play, flexibility, discovery, innovation." The dictionary is based on the one provided and validated by Uotila et al. (2009), who took key words from March's description of exploration and exploitation and used permutations of those words for their dictionary. Examples of phrases indicative of exploration and exploitation are listed in Table 1.

Our operationalization of exploration has unique advantages. First, content analysis "provides researchers with opportunities to unobtrusively study the values, sentiments, intentions, and ideologies of managers generally inaccessible to researchers" (Morris, 1994: 903).

Table 1. Sample Exploration/Exploitation Phrases

Learning Orientation	Sample Phrases
Exploration	"As a science-based, patient-focused organization, we discover and develop innovative therapies to treat grievous illness."
	"We develop and apply high-throughput experimentation to the discovery of innovative materials for chemical, energy, electronics, life science, and other industries."
Exploitation	"Our ability to sustain and improve profit margins is largely dependent on our ability to continue to improve the cost efficiency of our operations."
	"The rapid execution necessary for the Company to fully exploit the market for its products and services requires an effective planning and management process."

Second, content analysis may be useful for studying constructs that are difficult to assess otherwise (Duriau, Reger, & Pfarrer, 2007), which is a challenge faced by researchers trying to assess exploration/exploitation issues.

Industry technological dynamism — We measure industry technological dynamism at the level of the parent firm, as we are interested in how the environmental exigencies faced by the parent firm influence our main effect relationship. Industry technological dynamism is operationalized as an industry's R&D intensity, measured as the ratio of R&D expenditures to net sales for all firms in an industry at the four-digit SIC code level in a given year (Audretsch & Feldmann, 1996; Uotila et al., 2009). We collected data for this variable from the COMPUSTAT North America Fundamentals Annual database.

Control Variables

Firm size is controlled for by taking the natural logarithm of sales. Profitability is controlled for through return on assets, calculated by taking the ratio of net income to total assets. Financial slack is therefore controlled for by taking the difference between current assets and current liabilities (Bradley, Aldrich, Shepherd, & Wiklund, 2010). Firm leverage is controlled for by using the debt/equity ratio. The R&D intensity of the firm is also controlled for by taking the ratio of R&D expenses to net sales. The total number of exploitation words derived from the Uotila et al. (2009) dictionary are controlled for. The exploitation dictionary comes from March's (1991: 71) description of exploitation as "such things as refinement, choice, production, efficiency, selection, implementation, execution." We also controlled for the total size of the 10-K document via the total number of words used in the document.

To control for industry characteristics that may influence a firm's usage of acquisitions relative to other ECV modes beyond our explanatory variable of industry technological dynamism, we control for the parent firm's industry's capital intensity and complexity. Industry capital intensity is operationalized as the yearly ratio of total assets to total sales in an industry at the four-digit SIC level. We measure complexity by regressing the terminal-year (Year 5) market shares of firms in an industry (based on two-digit

SIC codes) on the same firms' initial-year (Year 1) market shares. This measure is essentially a trend toward or away from monopoly power in an industry over a 5-year period (Keats & Hitt, 1988).

A 5-year window on previous ECV activity is used to control for each of the three external venturing modes. The experience measure was decayed to account for the varying influence (for example) an acquisition in Year 5 would have compared to one in Year 2. The decay was calculated by dividing the specific ECV activity of (t – 1) by 1, dividing the specific ECV activity of (t – 2) by 2, dividing (t – 3) by 3, and so on. These decayed scores are then summated to create a measure that accounts for previous EVC activities in the past 5 years. We also controlled for total ECV activity in a given year by summating all three forms of external venturing by firm-year observation. Year dummies are used because certain forms of ECV may be more likely to occur in some years than others (Gompers, 2002) and to control for contemporaneous correlation (Certo & Semadeni, 2006).

Finally, we controlled for two aspects of the venture receiving investment. We control for industry similarity between the parent and the venture by creating a match score between the parent and venture, similar to Schildt et al. (2005). Scores include 0, 0.25, 0.5, 0.75, and 1, where a 1 is given if all four digits of the SIC codes match, a 0.75 is given if the first three digits match, and so on. We then created a yearly average based on the parent firm's yearly venturing activities. Similarly, we created a yearly average for venture age. Due to our focus on the formation of new JVs, JVs were coded as 0 years old at the time of the venturing activity.

Analytical Method and Results

Due to the fact that our sample is composed of firms that have self-selected into external venturing activities, we conducted an econometric technique developed by Heckman (1979) and commonly used to correct for self-selection bias (Sampson, 2007). Briefly, this procedure allows us to create a control variable, referred to as the inverse Mills ratio, which results from an initial probit model that captures the decision to engage in any form of external venturing. The sample for this initial model is composed of all publicly traded firms in our focal industries during the sample period (N = 15,316, including the 611 firms in our study); we dummy coded firms that were engaged in any ECV activity as 1 (CVC investment, JV creation, and/or acquisition) and those that were not as 0. The variables we utilized in the initial stage probit include firm employees, R&D expense, cash, total revenue, total assets, net sales, and net income. We then enter the inverse Mills ratio into our hypotheses-testing models, which corrects for the influence of self-selection bias (Leiblein, Reuer, & Dalsace, 2002).

A Hausman test indicated that a fixed-effects specification is preferred over a random-effects specification to control for unobserved heterogeneity (Wooldridge, 2010). We investigated for the presence of outliers (i.e., standardized residual > ±3 *SD*) that may influence our estimated models. We report our regression results with those outlier observations removed (four firms and 10 firm-year observations), though our results are largely similar with the inclusion of the outlier observations. We standardized all variables prior to entering them into the regression equations (Cohen, Cohen, West, & Aiken, 2003) and use robust standard errors.

Table 2 presents the descriptive statistics and correlation matrix for the variables used in the sample. Table 3 presents the results of the fixed-effect regression analyses. Model 1

Table 2. Descriptive Statistics and Correlation Matrix

	M	*SD*	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1. Relative acquisitions	0.32	0.45	—																	
2. Capital intensity	1.32	0.51	.16	—																
3. Industry complexity	0.85	0.17	.30	.10	—															
4. Average industry relatedness	0.42	0.39	.28	.23	−.08	—														
5. Average age of venture	2.68	3.87	.61	.13	.21	.17	—													
6. Debt/equity ratio	0.51	6.11	−.03	.01	.02	.00	−.03	—												
7. Sales (logged)[a]	6.96	2.54	−.18	−.09	.22	−.19	.03	−.03	—											
8. R&D intensity	0.30	1.04	−.06	.05	−.07	.01	−.08	.03	−.37	—										
9. ROA	−0.05	0.50	−.02	−.04	.05	−.03	.05	.00	.40	−.31	—									
10. Financial slack	1479.90	3573.46	−.05	.02	.14	−.07	.07	−.02	.43	−.06	.12	—								
11. Total words	5235.45	5554.62	.08	.10	.11	.03	.06	.03	.01	.00	.02	.08	—							
12. Exploitation	9.59	13.33	.02	.02	.12	−.03	.01	.07	.05	−.02	.02	−.02	.65	—						
13. Inverse Mills	0.34	0.25	.27	.17	−.18	.27	.04	.03	−.88	.22	−.25	−.43	−.01	−.05	—					
14. CVC experience	4.17	18.04	−.12	.05	.02	−.10	.00	−.01	.26	−.04	.06	.41	−.01	−.05	−.26	—				
15. JV experience	0.64	1.65	−.20	−.01	−.09	−.15	−.11	−.01	.39	−.07	.07	.21	−.06	−.05	−.40	.26	—			
16. Acquisition experience	0.30	1.00	.13	.07	.17	.03	.16	−.01	.25	−.04	.06	.42	.10	−.01	−.23	.14	.05	—		
17. Total ECV activity	3.27	9.10	−.13	.00	−.07	−.10	−.02	−.01	.26	−.04	.08	.35	.00	−.04	−.27	.78	.31	.11	—	
18. Industry R&D intensity	0.10	0.07	.08	.47	−.04	.29	.07	.01	−.23	.20	−.03	.08	.07	−.06	.32	.06	−.13	.04	.04	—
19. Exploration	10.24	15.86	.16	.05	.14	.07	.10	.04	.04	.00	.02	.14	.71	.54	−.03	−.03	−.08	.24	−.02	.00

Nonstandardized/nontransformed measures. CVC = corporate venture capital; ECV = external corporate venturing; JV = joint venture; ROA = return on assets. Correlations ± .05 and greater significant at a minimum $p < .05$ level.

a. Sales in millions.

Table 3. Fixed-Effects Regression Results (Dependent Variable: Relative Acquisition)

	Model 1		Model 2		Model 3	
Variable	β	*SE*	β	*SE*	β	*SE*
Capital intensity	−0.01	(0.01)	−0.00	(0.01)	−0.00	(0.01)
Industry complexity	0.02†	(0.01)	0.02†	(0.01)	0.02†	(0.01)
Average industry relatedness	0.01**	(0.00)	0.01**	(0.00)	0.01*	(0.00)
Average age of venture	0.13***	(0.02)	0.13***	(0.02)	0.13***	(0.02)
Debt/equity ratio	−0.01*	(0.00)	−0.01*	(0.00)	−0.01*	(0.00)
Sales (logged)	−0.02	(0.02)	−0.01	(0.02)	−0.01	(0.02)
R&D intensity	−0.09	(0.08)	−0.08	(0.08)	−0.08	(0.08)
ROA	−0.79	(1.20)	−0.96	(1.36)	−1.11	(1.40)
Financial slack	−0.00	(0.00)	−0.00	(0.00)	−0.00	(0.00)
Total words	0.00	(0.01)	−0.01	(0.01)	−0.00	(0.01)
Exploitation	0.00	(0.01)	−0.00	(0.01)	−0.01†	(0.00)
Inverse Mills	0.03**	(0.01)	0.04***	(0.01)	0.04***	(0.01)
CVC experience	−0.00	(0.00)	−0.00	(0.00)	−0.00	(0.00)
JV experience	−0.00	(0.01)	−0.00	(0.01)	−0.00	(0.01)
Acquisition experience	0.01***	(0.00)	0.01***	(0.00)	0.01***	(0.00)
Total ECV activity	−0.01	(0.01)	−0.01	(0.01)	−0.01	(0.01)
Industry R&D intensity			−0.02	(0.01)	−0.02	(0.01)
Exploration			0.02**	(0.01)	0.02**	(0.01)
Exploration × Industry R&D intensity					−0.01***	(0.00)
Constant	0.35***	(0.02)	0.36***	(0.02)	0.37***	(0.02)
F	13.49***		13.53***		15.42***	
R^2 (Within)	0.525		0.536		0.543	
R^2 (Between)	0.605		0.591		0.585	
R^2 (Overall)	0.684		0.589		0.587	
Log likelihood	1740.67		1756.57		1765.95	

N = 1,326; number of firms = 607. Year dummies omitted for parsimony. Robust standard errors beside coefficients in parentheses. CVC = corporate venture capital; ECV = external corporate venturing; JV = joint venture; ROA = return on assets.
† $p < .10$
* $p < .05$
** $p < .010$
*** $p < .001$

contains the control variables, Model 2 contains the controls and the independent variables, and Model 3 contains control, independent, and interaction variables.

The positive and significant ($p < .001$) coefficient for the exploration variable in Model 2 indicates support of Hypothesis 1, which posited that exploration has a positive relationship with the relative use of acquisitions within the firm's portfolio of equity-based ECV investments. The negative and significant ($p < .001$) coefficient for the Exploration × Industry R&D intensity interaction indicates support for Hypothesis 2, which stated that industry R&D intensity exerts a negative moderating influence on the relationship between exploration and the relative use of acquisitions within the firm's portfolio of equity-based ECV investments. We plot the significant interaction at ±2 standard deviations of technological

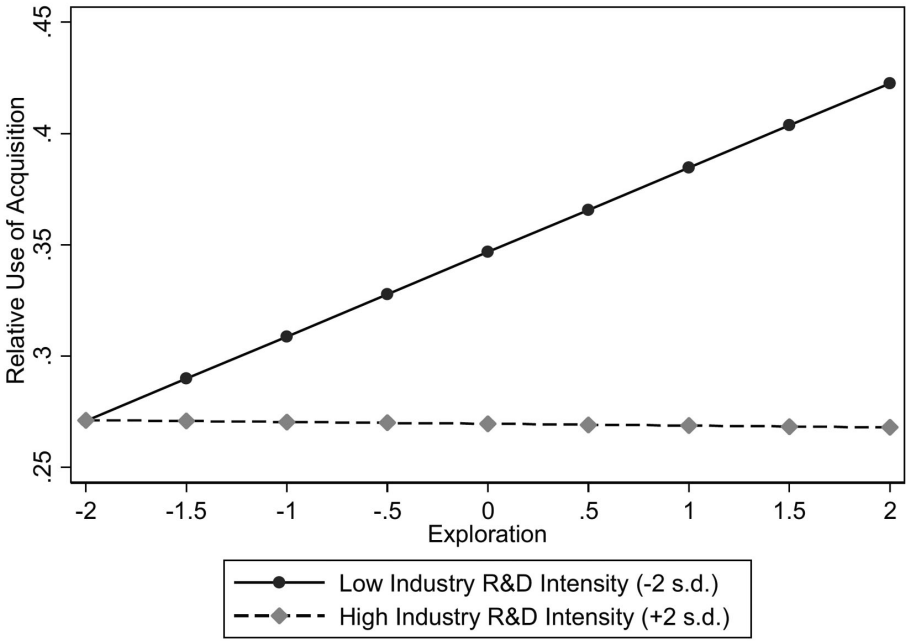

Figure 2. Interaction of Exploration and Industry R&D Intensity on the Relative Use of Acquisitions

dynamism in Figure 2. Likelihood ratio tests indicated that model fit improved when we tested Model 1 to Model 2, and improved again when we compared Model 2 to Model 3.

We further illustrate this interaction effect following Preacher, Curran, and Bauer (2006) in Figure 3. We show the average marginal effect of exploration on the relative usage of acquisitions at varying levels of industry R&D intensity with a 95% confidence band. As Figure 3 shows, the moderation effect of industry R&D intensity on the exploration–relative acquisitions relationship is not significant beyond around +1 standard deviation above the mean. In other words, industry R&D intensity does not have a meaningful impact on the relationship between exploration and the relative usage of acquisitions within an ECV portfolio for firms in highly technologically dynamic industries.

Supplemental Analysis

In our sample of firms, there are 31 firm-year observations (28 firms) that exclusively use exploitation words and 29 firm-year observations (28 firms) that exclusively use exploration words. Firms that exclusively use exploitation words tended to use few of them (have a low exploitation score), and firms that exclusively use exploration words tended to use few of them (have a low exploration score). To provide a greater understanding of the usage of each dictionary, we examined the descriptive statistics for a "relative exploration" measure, which is calculated as follows: exploration words/(exploration words + exploitation words). The mean and standard deviation are 0.50 and 0.24, and the minimum and

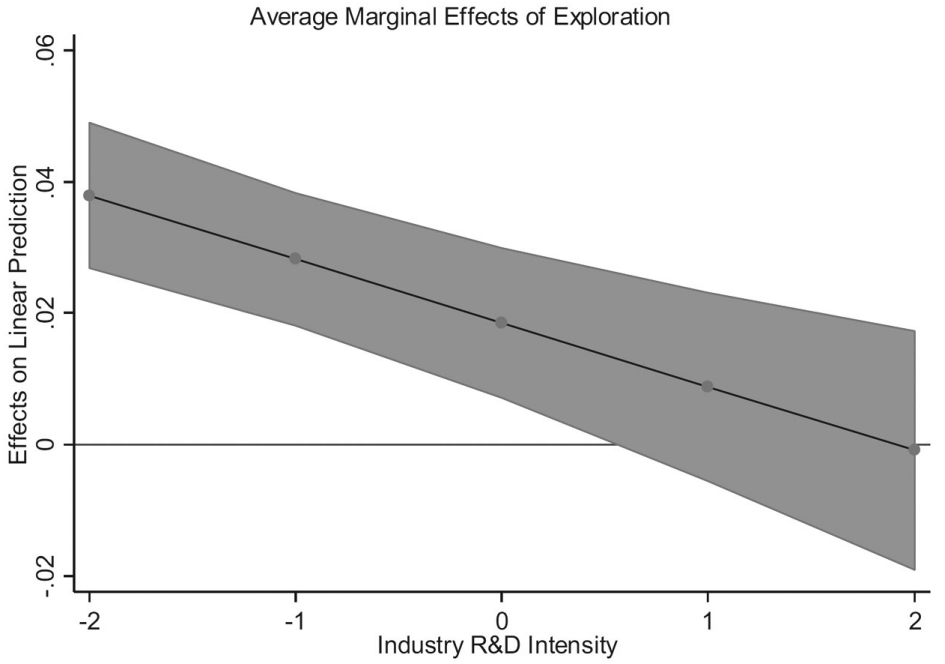

Figure 3. Average Marginal Effect of Exploration on Relative Acquisitions at Varying Values of Industry R&D Intensity

maximum are 0 and 1. In other words, most firms discuss both exploration and exploitation, and few tend to discuss one to the exclusion of the other.

We conducted two separate supplemental analyses to further parse the influence of exploration on ECV activity. Our ratio-based DV has upper and lower bounds (left and right censoring); examination of the minimum and maximum values of our DV indicates that the bounds are 0 and 0.8. We therefore conducted a Tobit regression analysis with upper and lower bounds specified. It is important to note that the Tobit analysis precludes us from utilizing fixed-effects estimation, so we utilize a random-effects model instead. As such, the Tobit regression is utilized exclusively as a robustness check. Results of the Tobit regression analyses are supportive of our hypotheses in terms of both direction and significance of the independent variables ($p < .05$ and $p < .001$ for Hypothesis 1 and Hypothesis 2, respectively).

For our second form of supplemental analysis, we used the "venture deal" as the level of analysis rather than the corporate parent. We had a sample of 3,783 venture deals, which were labeled as CVC investment, JV, or acquisition. Due to the categorical nature of the ECV mode variable, we tested for the appropriate modeling technique: a rank-ordered approach (such as an ordered logit) or a categorical approach (such as a multinomial logit). We conducted an approximate likelihood ratio test discussed by Wolfe and Gould (1998) and a Wald test discussed by Brant (1990) to test the parallel regression assumption, which assumes that the relationship between each pair of outcome groups is the same. Consistent with the work of van de Vrande et al. (2009), both tests indicated that the assumption

was violated, suggesting that it is inappropriate to treat the DV as ordered. That is, these analyses indicated that within the current sample, the likelihood that a firm would engage in one of the three observed ECV modes was *not* significantly related to the likelihood that that firm had previously or concurrently engaged in another of the modes. We therefore used a multinomial logistic regression with robust standard errors. A multinomial logistic regression compares the likelihood of an outcome with each of the other outcomes (i.e., acquisitions vs. CVC, acquisitions vs. JV, and CVC vs. JV).

Results of this supplemental analysis indicate that exploration increases the likelihood of acquisitions versus JVs ($p < .001$) and also increases the likelihood of CVC investments versus JVs ($p < .001$). Further, the interaction of exploration and industry technological dynamism decreases the likelihood of acquisitions versus either CVC investments ($p < .05$) or JVs ($p < .01$). In other words, firms with high levels of exploration operating in technologically dynamic environments are more likely to engage in CVC investments or JVs rather than acquisitions. The interaction also decreases the likelihood of CVC investments vs. JV ($p < .05$). Overall, the supplemental analysis provides broad support for our hypotheses.

Discussion

The ECV literature suggests that external venturing is a manifestation of exploratory behavior (Wadhwa & Kotha, 2006) and that certain forms of venturing are more likely to be related to exploratory rather than exploitative learning outcomes than others (Schildt et al., 2005). In this article, we utilize the organizational learning literature to develop hypotheses regarding the influence of exploration on (a) the usage of acquisitions relative to a firm's total equity-based ECV portfolio (including CVC investments and JVs) and (b) the moderating influence industry technological dynamism, as suggested by industry R&D intensity, exerts on the relationship between exploration and the relative use of acquisitions within the firm's portfolio of equity-based ECV investments.

Despite the common assumption that external venturing activities are motivated by exploratory learning objectives (Foss et al., 2013), this is the first study to explicitly test the influence of exploration on three different equity-based ECV modes. Prior work indicates that when firms engage in risky and uncertain interorganizational tie formation, they tend toward minimal commitment and flexible interorganizational arrangements (Folta, 1998; Schildt et al., 2005). This resonates with real-options logic, which has been utilized in several external venturing studies to predict ECV mode engagement (Tong & Li, 2011; van de Vrande et al., 2009). However, our results contrast with this perspective, as we find that firms engaged in exploration—an inherently risky activity—tend to utilize acquisitions more frequently (relative to their overall ECV portfolio) than other firms.

Consider the following from Google's 2006 10-K report:

> Our experiments with targeted ads in new media also open up new inventory options to AdWords advertisers. With the acquisition of dMarc in February 2006 and YouTube in October 2006, we have broadened the distribution options for our advertisers. In addition, we have been testing ad placements in mobile search.

This illustrates the exploratory nature of Google's acquisitions in 2006, as it explicitly discusses experimenting with the advertising program via the acquisition of dMarc and

YouTube. That our results contrast with real-options logic furthers our proposition that explicitly testing the relationship between exploration and ECV activities yields novel insight. We therefore contribute to the external venturing literature by explicitly testing an assumption that undergirds much of the literature.

There are two implications of this finding. First, the relative usage of acquisitions for firms engaged in exploration is consistent with the view that strong resource investment from a parent signals commitment to the venture, which may facilitate knowledge transfer (Wadhwa & Basu, 2013). Indeed, acquisitions allow the parent firm to ingest new human capital, routines, and knowledge, thereby expediting the exploration process (Phene et al., 2012). It is also interesting to note that while venturing activities may be motivated by exploitative learning motivations, our control variable for exploitation was not significant in Model 2, which tested the main effect relationship of exploration on the relative usage of acquisitions. This suggests that, at least in our sample, exploration—not exploitation—is the learning motivation that drives the usage of acquisitions in an equity-based ECV portfolio.

However, while our research indicates that acquisitions are used relatively more frequently by firms engaged in exploration, our research does not investigate whether exploratory learning benefits are, in fact, realized. The external venturing literature indicates that acquisitions can facilitate the creation of pioneering technologies for the parent firm *if* the acquisition target possesses novel technology (van de Vrande et al., 2011). In other words, firms that acquire ventures with novel new technologies may be able to effectively tap those technologies for innovations of their own. If the target venture does not possess novel technologies, then acquisition activities do not facilitate the creation of pioneering technologies. This indicates that firms engaged in exploration may engage in acquisitions relatively more frequently because they are pursuing cutting-edge technologies and knowledge that could generate pioneering new technology, or alternatively, the exploratory learning benefits they were after may rarely materialize.

Our work also indicates that the level of technological dynamism is a key consideration when examining the external venturing activities of firms engaged in exploration. The rapid change in technological demands and expectations exerts pressure to adopt new knowledge quickly. Drawing from the TCE premise that market exchanges are hazardous in uncertain environments (Leiblein & Miller, 2003), we suggested that technologically dynamic environments will attenuate the influence of exploration on the relative use of acquisitions. As noted by Folta (1998) and Tong and Li (2011), when exogenous uncertainty rises, investment flexibility becomes more salient. Our findings are consistent with this extant work, as we found that technological dynamism exerts a negative moderating influence on the relationship between exploration and the relative usage of acquisitions within the firm's portfolio of equity-based ECV investments, such that firms engaged in exploration tend to utilize acquisitions less frequently, relative to their total ECV activities, when they operate in technologically dynamic environments.

It is important to note that our analysis of the average marginal effect of exploration on the relative usage of acquisitions, illustrated in Figure 3, indicates that the moderation effect of industry R&D intensity on the exploration–relative acquisitions relationship is not significant beyond around +1 standard deviation above the mean (for the standardized score). This suggests that while technological dynamism exerts an attenuating effect on the exploration–relative acquisitions relationship, the stronger effect relates to technological stability. Specifically, industry technological stability *facilitates* the relationship between exploration

and the relative usage of acquisitions. These findings help reconcile the contrast between our findings and the received wisdom in the ECV literature. In other words, our finding that exploration drives the relative usage of acquisitions in technologically stable environments is consistent with prior literature (Folta, 1998; Tong & Li, 2011).

Our supplemental analysis provides further nuance by indicating that JVs are more likely than CVC investments for firms engaged in exploration in technologically dynamic environments. A tight linkage between the parent and venture can facilitate the flow of knowledge from the venture to the parent (Mowery, Oxley, & Silverman, 1996). The interorganizational learning literature highlights the importance of resource commitment to learning, as resource commitment can help align the incentives of the parties (Santoro & McGill, 2005) and can help with partner commitment (Kang, Mahoney, & Tan, 2009). Within the context of technologically dynamic industries, JVs offer a unique combination of access to knowledge stocks and the splitting of risk in the face of environmental uncertainty. As suggested by Siggelkow and Levinthal (2003: 666) in reference to exploring in high-change environments, "only firms that employ organizational features that both push the firm toward exploration and pull it toward stability tend to have high performance." JVs represent such a mechanism that allows for stability through a purposefully built venture designed specifically for the learning goals of the corporate parents.

We therefore contribute to the organizational learning literature by complementing it with the TCE literature and demonstrating the relevance of environmental context to the venturing choices made by firms that emphasize exploratory learning. Specifically, our research demonstrates how engagement in exploration exerts a different influence on external venturing activities based on environmental conditions. While this research does not examine the effectiveness of various venturing modes, it does show that environmental conditions can influence how a firm's engagement in exploration influences its strategic activities. Thus, the current results underscore an important observation recently highlighted by Danneels and Sethi (2011), namely, that consideration of environmental context is a fundamental component to developing an understanding of organizational learning.

Future Research and Limitations

There are several opportunities for future research that can extend this study and address its limitations. First, since we chose to focus exclusively on equity-based external venturing, we did not include nonequity alliances despite their usage in other ECV research (Keil, Maula, et al., 2008). Future research could address the challenge posed by equity versus nonequity relationships by explicitly articulating relevant differences between them and proposing methods to address the challenge. Second, the multitude of operationalizations for the exploration/exploitation presents both a challenge and opportunity. Our measure followed the textual analysis method utilized and validated by Uotila et al. (2009). Similar to the work of Palich, Cardinal, and Miller (2000), who reviewed how different measures of diversification influence the diversification-performance relationship, the learning literature would benefit from a comprehensive review and analysis of the different methods of measuring exploration/exploitation.

Third, though we utilize a number of control variables to mitigate concerns of omitted-variable bias, the possibility of such a bias has not been entirely eliminated. The firm fixed effect that we adopt accounts for unobserved heterogeneity for the corporate parent, though there are likely characteristics of the venture itself that are important (e.g., size, patent

portfolio, operating environment, etc.) and are not controlled for in this study. Future research could focus more extensively on how characteristics of the venture influence the formation of an external venturing relationship. Fourth, our operationalization of the DV assumes comparability of acquisitions to CVC investments and JVs. This assumption aligns with prior ECV research (Keil, Maula, et al., 2008; van de Vrande et al., 2009), though we recognize that each form of external venturing is unique, and prudent caution is advised when comparing different forms of ECV. Finally, our findings indicate that the relative use of acquisitions is driven by a firm's engagement in exploration. Interestingly, Ahuja and Katila (2001) found that organizations tend to overexplore or overexploit in their acquisition decisions. Future research could examine the possibility that while acquisitions are more strongly influenced by exploration, exploration-driven acquisitions within the ECV context may have a negative impact on firm performance, and other forms of external venturing might be more appropriate.

Conclusion

A firm's engagement in learning plays a critical role in its utilization of different processes to search for new opportunities. External corporate venturing activities are a means by which firms manifest their exploratory search processes and are practiced by established organizations that are powerful industry incumbents. Though research in ECV has examined antecedents to a particular form of venturing activity in isolation of other forms of venturing, antecedents to venturing activities as they relate to each other has only recently gained scholarly attention. This article attempts to further the understanding of both organizational learning and ECV by addressing this knowledge gap. Our findings indicate that in technologically dynamic environments, exploratory firms seek to maintain external venturing flexibility via CVC investments or JVs. However, when the environment is more certain—that is, when technological dynamism is low—firms tend to commit to their external venturing investments via acquisitions. While some prior research suggests that exploration is realized through acquisitions, and other research suggests that exploration is realized through less "committed" ECV options, such as CVC investments or JVs, both observations are, in fact, valid. The critical component missing in the literature is an understanding of how uncertainty affects an exploratory firm's relative use of different external venturing options. Though venturing activities are utilized in distinct contexts and for distinct reasons, they are part of the strategic toolkit of some of the most innovative, forward-looking companies seeking to be competitive in an ever-evolving landscape.

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