Alliance Portfolio Diversity and Firm Performance: Examining Moderators

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The issue of the appropriate level of diversity in an alliance portfolio has emerged as a critical issue for managers and scholars. This study provides insight into how characteristics of alliance portfolios moderate the relationship between alliance portfolio diversity and firm performance. Firms should be able to best take advantage of diverse alliance portfolios when they have characteristics that enhance trust, knowledge sharing, and innovation. The effects of reciprocity and status similarity on the alliance portfolio diversity-firm performance relationship are examined. The findings of this study support the hypothesized inverted-U relationship between alliance portfolio diversity and firm performance. Findings also show that alliance portfolio characteristics are significant moderators of the alliance portfolio diversity-performance relationship. As predicted, reciprocity positively moderates this relationship while status similarity is unexpectedly found to negatively moderate this focal relationship.

A growing body of literature is focused on how individual firms benefit from a wide range of inter-firm alliance relationships. The benefits to firms can include increased legitimacy, enhanced stability, and reduced risk (Cowan & Jonard, 2009). Furthermore, partnering with multiple firms can "provide a superior means to access or acquire capabilities" and knowledge that firms cannot develop internally (Sampson, 2007, p. 365).

Not all alliances offer the same benefits and not all firms benefit equally from alliance partnerships. A growing number of studies have focused on alliance portfolio diversity as a driver of firm performance. Alliance portfolio diversity has been operationalized a number of ways, including heterogeneity of alliance type (Sarkar, Aulakh, & Madhok, 2009), technological knowledge (Ahuja, 2000; Sampson, 2007),

partner nationality (Koka & Prescott, 2002, 2008) and industry (Goerzen & Beamish, 2005). Greater alliance portfolio diversity has been found to have both positive and negative effects on firm performance. Studies that found positive effects attributed this to improvement in information accuracy and in innovativeness and creativity resulting from diverse knowledge (Beckman & Haunschild, 2002; Baum, Calabrese, & Silverman, 2000). Others have found that diversity, beyond very low or moderate levels, contributed to poorer performance and theorized that this was due to coordination and integration costs that outweighed the benefits of diversity (Ahuja, 2000; Goerzen & Beamish, 2005). While the existing body of research that investigated the relationship between alliance portfolio diversity and firm performance provided interesting insights, the limited and conflicting empirical evidence "prevented researchers from understanding how firms can best use alliances as part of their knowledge creation strategies" (Sampson, 2007, p. 382). Mixed findings in prior studies suggested that there are important moderators of the diversity-performance relationship that have not been studied. However, few studies have looked into alliance portfolio characteristics as moderators of this relationship. The existing research gap in this regard provided motivation for the current study. This study will first examine the relationship between alliance portfolio diversity and firm performance. The focus will then shift to two alliance portfolio characteristics — status and reciprocity — that are suggested as likely moderators (Benjamin & Podolny, 1999; White & Lui, 2005). The objectives of this study were to identify whether: a) evidence supports the hypothesized relationship between alliance portfolio diversity and firm performance, and b) to further understand potential moderating influences on that relationship.

Theoretical Development

Alliance Portfolio Diversity

Alliance portfolio diversity pertains to the heterogeneity of knowledge and resources represented across the portfolio of partnerships (Collins, 2013). Engaging in inter-firm alliances is driven in large part due to a desire to access a variety of resources and knowledge that are expected to help to improve overall firm performance. Alliance portfolios can then significantly vary in diversity (Jiang et al., 2010; Vasudeva & Anand, 2012). Investigating portfolios of alliances enables analysis of very different phenomena than when observed as an individual phenomenon based on a partner's technological capability (Anand et al., 2007; Vassolo et al., 2004). When the partners' technological approaches overlap, new ideas and knowledge are not being generated, instead alliance partners find a redundant theme of skills sets, ideas, and knowledge that lead to a weakened alliance portfolio (Anand et al., 2007).

Alliance portfolio diversity has been defined as the extent of variance in a focal firm's alliance partners, functional scopes, and authority or governance structures (Jiang et al., 2010). Prior research suggests that in order to achieve a strategic balance in new and old partnerships, firms involved should pursue partnerships across industries (Kruss, 2008). Industry-related diversity also has been highlighted in prior research as a critical way to achieve technology transfer (Chunhua, Mengchun, & Baojun, 2011) and used as a primary mechanism for successful new market entry (Hirt, Smit, & Wonsik, 2013).

It has been argued that being involved with several alliances under a coordinated portfolio approach can provide value beyond that of individual alliances (Anand et al., 2007). Primary among the potential benefits, portfolios of alliances with other firms have a significant impact on a firm's innovation (Sampson, 2007) and overall firm performance (Jiang et al., 2010). Therefore, alliance portfolio diversity has also been identified as a salient construct when addressing the influence of alliance partnerships on a focal firm's performance (Cui & O'Connor, 2012). Improved firm performance is supported when inter-firm collaboration occurs within a diverse portfolio of alliances (Cui & O'Connor, 2012).

The optimal level of alliance portfolio diversity has emerged as a critical issue for managers and scholars as it is seen as a driver of the type and extent of knowledge transferred and overall firm performance (Collins, 2013; Vasudeva & Anand, 2012). It is widely recognized that managers use alliances to gain access to timely and relevant knowledge beyond what their firms can obtain alone (Hoffman, 2005). Alliances facilitate sharing between firms by establishing communication conduits enabling effective interactions between partnering firms to share best practices and other knowledge, to collaborate on joint problems, and to develop joint competencies (Kale & Singh, 2007; McGill & Santoro, 2009). Knowledge gained from alliance partners can enhance firm performance by increasing innovativeness and adaptability and by helping firms to recognize new opportunities (Gupta & Misra, 2000; Jiang et al., 2010).

Some have suggested that alliance partners with similar knowledge enjoy greater success in learning, innovation, and performance (Ahuja, 2000). Partner homogeneity may reduce conflict, facilitate knowledge sharing and assimilation, and enhance trust. Some research on individual alliances has provided support for this perspective, finding that as similarities increase, partners are more likely to share knowledge and to improve their innovation performance (Ahuja, 2000; Darr & Kurtzberg, 2000). However, others suggest that homogenous partners may be less able to take advantage of new opportunities and to generate innovative ideas and new capabilities because sharing similar knowledge and resources may be limiting (Hitt et al., 2001). Alliance partners having disparate knowledge, perspectives, technologies, and experiences can potentially learn more from each other, have a broader perspective, and be more innovative and creative, resulting in better performance than firms with more homogenous alliance portfolios (Beckman & Haunschild, 2002; Capaldo, 2007). These arguments have also been confirmed by empirical research that found that firms with a wide range of partners outperform those with more homogenous alliance partners (Baum et al., 2000).

Attempting to reconcile the contradictory arguments and findings, recent studies have tested and found a more complex relationship. Sampson (2007), using a telecommunications industry sample comprised primarily of U.S. and European firms, found an inverted U-shaped relationship between alliance technological diversity and performance. As diversity rose, performance improved until at high levels of diversity, performance began to decline. Thus, alliances with moderately diverse technological knowledge contributed more to firm innovation than alliances characterized as having relatively high or low levels of diversity. The study concluded that while increased technological diversity among partnering firms improved performance to a point, as

diversity became too high, the ability of firms to assimilate knowledge began to decline and performance suffered.

As alliance portfolio diversity begins to increase, firms should experience improved performance due to the benefit of having access to complementary stocks of knowledge (Rodan & Galunic, 2004). This knowledge can be combined in meaningful ways with a firm's existing knowledge, enabling the firm to capture new operational efficiencies, redesign their products and processes, and enhance product/service features. However, the relationship is expected to eventually become negative as the knowledge acquired via the portfolio of alliances becomes so diverse that it is increasingly difficult for partners to communicate and combine their knowledge and capabilities. Therefore,

> *Hypothesis 1: A curvilinear (inverted U-shape) relationship exists between alliance portfolio diversity and firm performance.*

Alliance Portfolio Characteristics

While firms are expected to benefit from alliance portfolio diversity as that diversity initially increases and then see the benefits diminish as alliance portfolios become overly diverse, they are better able to realize gains from such diversity when their alliance partnerships are marked by frequent and intense interactions (White & Lui, 2005). Therefore, certain alliance portfolio characteristics are argued to moderate the relationship between alliance portfolio diversity and firm performance. Embeddedness, the extent to which exchanges between partnering firms are shaped by social relations, directly influences the amount and quality of knowledge available via these partnerships (Uzzi, 1996). Repeated exchanges build trust and improve both the stability of relationships and knowledge sharing (Hagedoorn, 2006). Because not all firms are equally embedded, firms are likely to differentially benefit from a diverse alliance portfolio.

In part, the nature of connections held by a focal firm determines the degree to which the exchange of high quality, complementary stocks of knowledge is possible (Uzzi & Gillespie, 2002). Being highly embedded leads to close and detailed interactions, enabling firms to "create common languages, problem definitions, and problem solving heuristics" (Cowan & Jonard, 2009, p. 322) and to address problems that are difficult to understand and solve. Embeddedness also reduces information asymmetry problems (Hagedoorn, 2006). In addition, reputation benefits accrue to deeply embedded firms, which are often viewed as desirable partners that can provide access to knowledge and to potential partnership opportunities with other firms (Brass, Butterfield, & Skaggs, 1998). Embedded firms therefore, have knowledge-related and reputational advantages that increase the probability they will continue to access additional knowledge by entering into future alliances (Cowan, Jonard, & Zimmerman, 2007).

The presence of alliance portfolio characteristics that promote cooperative behaviors can help firms overcome the downsides of alliance diversity. For example, Artz and Brush (2000) found that the performance of diverse alliance partners improved as the connections between the parties deepened, enhancing trust and increasing opportunities for retaliation if either partner behaved opportunistically. Therefore, a firm can expect cooperation from others in its portfolio of alliances and a reduced

threat of opportunistic behavior by affecting actors' motivations, expectations, and decision-making processes (Capaldo, 2007, Uzzi, 1996). Here, two specific alliance portfolio characteristics are examined, reciprocity and status similarity, that are expected to significantly influence the ability of firms to combine diverse knowledge to improve overall firm performance, thereby moderating the relationship between alliance portfolio diversity and firm performance. Reciprocity is examined because it shapes the formation of attitudes regarding appropriate behavior by partnering firms. Status similarity is investigated because it influences the extent to which firms are willing to engage in various behaviors in regards to their alliance partners.

Reciprocity

Firm-to-firm connections encourage reciprocity in which actors will behave in a manner consistent with expectations while not receiving any direct benefit in return. Reciprocity is the expectation that partnering firms will make "quid pro quo exchanges within the group" (Das & Teng, 2002, p. 449). If reciprocity exists, the risk of opportunistic behavior is lowered significantly, coordination costs are reduced, and the likelihood of cooperation is enhanced (Artz & Brush, 2000). Should a party in an exchange violate an existing partnership norm, other firms have "a context for generalized reciprocal 'retaliation', defined broadly as the repayment of injurious or otherwise undesired acts" (Westphal & Zajac, 1997, p. 164). In other words, opportunistic behavior by one party in the current period can be met by opportunistic behavior by the other party in the next. Similarly, cooperation can be met with cooperation. Reciprocity increases a firm's willingness to incur short-term disadvantages since they are confident that future opportunities to recoup any concessions will exist.

The level of reciprocity within a firm's alliance portfolio is argued to moderate the relationship between alliance portfolio diversity and firm performance. A firm that violates norms can be collectively punished by numerous alliance partners or selectively punished by individual firms. The possibility of reciprocal behavior causes partnering firms to focus on actions that enhance relationships and discourage self-serving behaviors (Parkhe, 1993). Thus, firms are more willing to share proprietary knowledge, invest in alliance specific assets, and engage in joint activities to integrate knowledge (Artz & Brush, 2000). Thus, fear of damaging the firm's reputation is often a motivating factor to abide by reciprocity expectations. As a result, while greater alliance portfolio diversity can increase the difficulty of coordinating knowledge between partnering firms, reciprocity is expected to moderate those pitfalls and improve firm performance. Thus,

> *Hypothesis 2: Reciprocity within an alliance portfolio positively moderates the relationship between alliance portfolio diversity and firm performance.*

Status Similarity

Firms tend to pursue alliance partners that differ in some dimensions, but are similar in others (Kim & Higgins, 2007). Differences in technologies, knowledge and other capabilities can provide complementarities that create significant value (Hamel, Doz, & Prahalad, 1989). The potential benefits that accrue from such diversity can be

difficult to realize because of communication and coordination difficulties. Firms, then, have a tendency to also seek partners who are similar on some dimensions, as these similarities encourage social bonding, build trust and facilitate knowledge sharing. Thus, alliances are most successful when partners possess some complementary resources and capabilities, yet are similar enough to facilitate the social bonding necessary for effective coordination (Kim & Higgins, 2007).

Firm status, the prominence achieved by a firm, is one of the dimensions in which similarity influences alliances (Lin, Yang, & Arya, 2009). Status derives from the firm's ability to exercise power and influence over other alliance partners (Swaminathan & Moorman, 2009). Status, which is determined by patterns of affiliations and previous exchanges, strongly influences how potential partners view a firm's capabilities, quality, and reputation (Podolny, 1994).

Much of the existing alliance literature has focused on how status affects partner selection. Certainly, there are significant moral hazards (e.g., uncertainty and the possibility of opportunistic behavior such as stealing a partner's technology) that make alliance formation risky (Gulati & Sytch, 2007). One of the ways to alleviate these threats is through the development of close ties, which are important because extensive relations promote trust. Close ties allow firms to deeply understand each other's capabilities and thereby develop shared norms, evaluation processes, and knowledge-sharing routines (Walker, Kogut, & Shan, 1997). Extensive relations between alliance firms encourage each party to commit significant relationship-specific investments that only have value if a productive relationship between the parties is maintained. Close ties also promote joint problem-solving and the transfer of detailed knowledge (Uzzi, 1996). Greater knowledge sharing increases the likelihood that opportunistic behavior will be discovered and that such behavior will quickly become known to other related parties, thus damaging the offender's reputation (Gulati, Nohria, & Zaheer, 2000).

Partnering with firms of similar status creates close ties leading to numerous relationship dynamics that can enhance trust, facilitate knowledge sharing, and of primary concern in this research, moderate the alliance portfolio diversity-performance relationship. For example, high-status firms are very selective in their choice of alliance partners, as their status, reputation, and performance can suffer greatly from affiliations from disreputable partners (Stuart, 2000). As a result, high-status firms have been found more likely to ally and to form close relations with firms of similarly high status (Chung, Singh, & Lee, 2000; Lin et al., 2009). Others have suggested that firms of similar status assume that knowledge acquired is accurate and relevant, encouraging the exchange of more fine-grained knowledge, and further deepening ties between firms. In contrast, knowledge from firms with a lower status position is frequently less trusted and valued by other firms (Westphal & Zajac, 1997). Status similarity also lessens the power differential between partners and promotes mutual dependence (Gulati & Sytch, 2007). This mutual dependence means that the action of one partner is increasingly influenced by the actions of the other. Status similarity thereby encourages commitment and fairness and prompts firms to equally share alliance responsibilities, costs, and benefits.

While the potential benefits described above help to explain the empirical findings that firm status matters in alliance formation and that firms prefer to ally with others

of similar status, the management of alliances between firms of similar status are not without problems. An alliance between low-status firms in which neither firm possesses the experience nor systems necessary to manage relationships, can make the alliance difficult and unproductive. Moreover, such alliances may not provide the positive reputational and legitimacy effects necessary to attract additional higher status alliance partners and improve performance (Lin et al., 2009). Alliances between high-status firms can also be problematic because each partner wields significant power and influence. This power can result in conflict if either firm acts self-servingly and seeks to redistribute the overall value of the relationship in its favor (Gulati & Sytch, 2007).

It is also true that many alliances form between partners of different status. High-status firms may ally with low-status firms to access particular technologies or technical skills (Deeds & Hill, 1996). Low-status firms may ally with high-status firms to access new markets, speed product development, and enhance their reputations (Lin et al., 2009). However, alliances between firms of different status are likely to be more limited in scope and yield fewer potential benefits. In such alliances, the higher status firm may not fully commit its resources to joint efforts since the additional resources provided by the low-status firm may not greatly boost performance. Yet, the lower status firm expects the higher status firm to commit more resources as a sign of its commitment to the alliance. Thus, the expectations of firms of differing status are likely to diverge, leading to conflict. These conflicts usually make alliances between firms of dissimilar status less effective than those between firms of similar status (Chung et al., 2000).

The above arguments suggest that alliances between firms of similar status have a greater potential to provide significant value than those between firms of different status. Therefore it is posited that as status similarity between firms increase, it will have an increasingly positive effect on knowledge sharing, joint problem solving, coordination, and the like. These relationship characteristics will increase the ability of firms to realize the benefits from alliance portfolio diversity. Therefore,

> *Hypothesis 3: Status similarity within an alliance portfolio positively moderates the relationship between alliance portfolio diversity and firm performance.*

Methodology

Data and Measures

The sample consisted of a randomly selected panel of 300 Standard & Poor's 500 firms between 1999 and 2004. Alliance data were from the Securities Data Corporation (SDC) Database on Alliances and Joint Ventures, and financial data were from Compustat. The analyses in this study were based on a fixed-effects approach to control for omitted variables. Moreover, since the data for this study were panel data, cross-sectional time-series regression analysis were utilized to control for heteroskedasticity, autocorrelation among error terms, and contemporaneous correlation among residuals (Certo & Semadeni, 2006).

Dependent Variable

The dependent variable, *firm performance,* was operationalized as the return on

assets (ROA) in each year of the study. ROA was lagged by one year for each year within the window of observation (Zaheer & Bell, 2005).

Independent Variables

Alliance portfolio diversity was calculated as a heterogeneity index (Blau, 1977; Blau et al., 1982) related to the four-digit SIC codes of each firm with which a focal firm had an existing joint venture (JV) relationship. A high score indicated a high degree of diverse potential knowledge which could be exchanged between partner firms. This measure was calculated as:

$$1 - \sum p_i^2$$

where p was the proportion of sample in a given category, and i was the number of different categories across the sample.

Index measures are commonly used to assess diversity in categorical data. A perfectly homogeneous population would have a diversity index score of zero. A perfectly heterogeneous population would have a diversity index score of one (assuming infinite categories with equal representation in each category). As the number of categories increased, the maximum value of the diversity index score also increased.

Reciprocity was operationalized using density of a firm's alliance ties, a proxy for the overall level of reciprocity facing a firm (Wasserman & Faust, 1994). The density of each firm's ties was the ratio of its total number of ties to the total possible ties (Carrington, Scott, & Wasserman, 2005). The total possible connections for each firm represented the total number of connections which would exist if all firms in the sample were uniformly connected with all other firms via one direct connection. Thus, the total number of ties was calculated and then divided by the total possible connections. The total number of possible connections was defined as the number of connections required to connect all firms in this study via direct ties (Carrington et al., 2005). This measure was appropriate given "greater density makes ideas about proper behavior more likely to be encountered repeatedly, discussed and fixed; it also renders deviance from resulting norms harder to hide and, thus, more likely to be punished" (Granovetter, 2005, p. 34).

Status similarity was arrived at by first calculating the focal firm's and each partner firm's centrality in their alliance portfolio, which was a frequently used measure of firm status (Bonacich, 1987; Salk & Brannen, 2000). Centrality indexes measured the degree to which an actor was close to all other firms in the sample, either directly, or indirectly. A firm that was maximally close was directly related to all other sample firms. Mediated relationships were accorded increasingly less weight than direct relationships with each intervening node. Numerous approaches to measuring centrality existed in the literature (see Bonacich, 1987; Freeman, 1979). The primary interest for this study was 'betweenness' centrality, based on Freeman's (1979) formula (Carrington et al., 2005). This formula summed the probability of a firm falling on the shortest path between any two pairs of firms over all unordered pairs of firms. This value was then divided by $(n^2\text{-}3n + 2)/2$, where n equaled the number of firms in the sample.

The measure reflected the extent to which a focal firm mediated the knowledge flows between any two other firms. Then the ratio of the smaller to the larger centrality score of the focal firm and each of its partners was computed. The closer this ratio was to 1.0, the more similar the two firms' structural positions were (Gulati & Gargiulo, 1999; Podolny, 1994). Finally, status similarity was computed as the average ratio across all of a firm's partners.

Control Variables

Firm age was operationalized as the natural log of the number of years since the initial founding of each firm. *Firm diversification* was based on an entropy measure to calculate product diversification (Collins et al., 2009; Palepu, 1985), and *firm size* was measured as the log of number of employees. Industry-level controls included *industry revenue growth,* measured as the average level of revenue growth for firms in each industry represented in the sample, and *industry capital intensity,* measured as the average level of property, plant, and equipment held by firms within each industry. At the firm-level *revenue growth* and *capital intensity* were each control variables. Finally, two control variables related to a firm's alliances were also included: *total number of alliances* and *average duration of alliances*.

Empirical Results

Table 1 provided a correlation matrix while Table 2 reported the results for the hypotheses testing. The results of the analyses provided general support for the first two hypotheses. The curvilinear relationship between *alliance portfolio diversity* and *firm performance* supported Hypothesis 1. Firm performance initially increased as alliance portfolios became more diverse, before turning negative at higher levels of diversity. This result suggests firms indeed benefitted as they initially developed a more diverse set of alliance partnerships. Eventually managing a very diverse portfolio of partnerships became detrimental to the focal firm as it was increasingly difficult for partners to communicate and combine their knowledge and capabilities. *Reciprocity* positively moderated the relationship between *alliance portfolio diversity* and *firm performance,* confirming Hypothesis 2. This result indicated that firms benefit as they developed higher levels of reciprocity within their alliance portfolios. Reciprocity led to firms being more willing to share proprietary knowledge, engage in joint activities to integrate knowledge, and invest in alliance-specific assets. As a result, while greater alliance portfolio diversity could increase the difficulty of coordinating knowledge between partnering firms, reciprocity was expected to moderate those pitfalls and improve firm performance.

Somewhat surprisingly, Hypothesis 3 was not supported. Status similarity negatively moderated the *alliance portfolio diversity-firm performance relationship,* contradicting the expected positive moderating effect. This result indicated firms may actually garner more benefits from having alliance partners of dissimilar status positions. The control variables *firm age, firm size,* and *firm capital intensity* were each statistically significant in the analyses. In the full model, *industry revenue growth* was also significant.

Table 1: *Correlation Matrix*

	Mean	Std Dev	1	2	3	4	5	6	7	8
1. Firm Performance	0.03	0.62	1.00							
2. Firm Age	4.28	3.91	0.14	1.00						
3. Firm Size	3.70	4.11	0.23 *	0.11	1.00					
4. Diversification	0.69	0.11	-0.01	0.17	0.31 *	1.00				
5. Firm Revenue Growth	0.49	0.69	0.02	-0.05	-0.10	-0.03	1.00			
6. Firm Capital	8.21	1.37	0.17	0.22 *	0.23 *	0.06	0.02	1.00		
7. Industry Revenue Growth	0.03	0.05	0.08	0.32 **	0.02	0.01	0.00	0.41 ***	1.00	
8. Industry Capital Intensity	6.25	1.57	0.08	0.21 *	0.14	0.26 *	0.01	0.43 ***	0.47 ***	1.00
9. Total Number of Alliances	3.42	8.68	0.09	-0.06	0.21 *	0.18 *	0.00	0.37 **	0.02	-0.06
10. Duration of Alliances	11.50	34.26	0.05	0.06	0.06	0.15	-0.02	0.39 **	0.26 *	0.18 *
11. Alliance Portfolio Diversity	0.64	0.18	0.04	0.07	0.04	0.13	0.03	0.39 **	0.17	0.16
12. Reciprocity	0.20	0.26	-0.03	0.00	0.02	0.20 *	-0.02	-0.17	-0.03	0.00
13. Status Similarity	0.19	0.58	0.08	-0.10	0.17	0.14	0.00	0.35 **	0.04	-0.04

	Mean	Std Dev	9	10	11	12	13
9. Total Number of Alliances	3.42	8.68	1.00				
10. Duration of Alliances	11.50	34.26	0.51 ***	1.00			
11. Network Diversity	0.64	0.18	0.41 ***	0.34 **	1.00		
12. Reciprocity	0.20	0.26	-0.43 ***	0.00	0.05	1.00	
13. Status Similarity	0.19	0.58	0.25 *	0.44 ***	0.30 *	-0.20 *	1.00

n = 1315

* = p<.05; ** = p<.01; *** = p<.001

Table 2: *Regression*

Dependent Variable = Firm Performance	Model 1		Model 2		Model 3	
Firm Age	0.002	***	0.002	***	0.002	***
Firm Diversification	0.024		0.014		0.012	
Firm Revenue Growth	0.001	*	0.001		0.005	
Firm Size	0.033	***	0.022	**	0.026	**
Firm Capital	0.026	***	0.026	***	0.030	***
Industry Revenue Growth	-0.010		-0.011		-0.024	†
Industry Capital	-0.006		-0.005		-0.008	
Total Number of Alliances	0.000		0.000		0.000	
Duration of Alliances	0.000		0.000		0.002	
Alliance Portfolio Diversity	0.343	**	0.554	***	0.384	**
Alliance Portfolio Diversity^2	-0.317	**	-0.630	***	-0.467	**
Reciprocit			0.285	**	0.304	**
ReciprocityXDiversity					0.189	*
Status Similarity			-0.234	*	-0.239	*
Status					-0.335	**
Wald chi^2	48.99	***	65.17	***	71.49	***

† = p<.10
* = p<.05
** = p<.01
*** = p<.001
n = 1315

Discussion

The findings here added evidence to the small, but growing number of studies that have examined the relationship between alliance portfolio diversity and overall firm performance. The findings of this study supported the hypothesized inverted-U relationship between alliance portfolio diversity and firm performance. This study's findings were in line with Sampson (2007), despite the fact that her study used an

innovative performance measure, post-alliance patents, and the focal study used a financial performance measure. Both studies found an inverted-U relationship.

Another significant contribution of this study was that the findings showed that alliance portfolio characteristics (i.e., reciprocity and status similarity), were significant moderators of the alliance portfolio diversity-performance relationship. As predicted and consistent with past findings, reciprocity positively moderated the relationship between diversity and performance (Artz & Brush, 2000; White & Lui, 2005). Reciprocity was expected to positively moderate this relationship because norms of reciprocity would mitigate some of the coordination costs associated with sharing knowledge across alliance partnerships. Those firms that were more heavily embedded in alliance relationships did see a benefit to firm performance.

The findings on status similarity complemented the alliance portfolio diversity finding. It was expected that firms with alliance portfolios characterized by greater status similarity would experience performance benefits and that status similarity would positively moderate the returns to diversity. Instead, both the main and moderating effect for status similarity were negative. Thus, diverse alliance portfolios offer greater returns. This finding supported the growing emphasis of the benefits of accessing diverse knowledge across a firm's portfolio of partnerships.

High-status firms were likely to have developed alliance management mechanisms and expertise. Because alliance management capability was firm-specific, the particular processes and practices that comprised alliance management capabilities varied from firm-to-firm. Low-status firms, while they may be very successful in a particular alliance, were less likely to have highly ingrained alliance management capabilities (Winter & Szulanski, 2001). Two high-status firms with different alliance capabilities may experience a higher degree of conflict as both seek the upper hand and because there were disagreements about which partners' firm-specific processes and structures to use. Low-status firms may lack the well-established processes that have been honed through past alliances, making them less efficient and/or effective in structuring and managing an alliance. On the other hand, when a low-status and high-status firm partner, there may be less conflict and the high-status firm will often take the lead in ensuring that appropriate and effective structures and management are in place. A lower status firm may cede leadership in this area because certain firms tend to be perceived by others as being more expert in executing and managing alliances (Hamel, 1991) and centrally-located (i.e., high-status) firms are likely to be perceived this way.

In sum, the results of this study suggested that one must be cautious in applying findings about what leads to success at an individual alliance level to the firm-level effects of alliances. Future studies also must be cautious in equating factors that have been found to increase the propensity to form an alliance with factors that will enable a firm to benefit from its portfolio of alliances.

Limitations/Future Research

One limitation of this study is the lack of control for technological complexity of the alliances in the study. Certainly the nature of the knowledge utilized within a given alliance can vary greatly. Including either a control variable or a fine-grained predictive

variable in future research would make for interesting studies. Future work could also further the understanding of factors that positively and negatively impact alliance portfolio diversity. In addition to variables such as number and strength of social capital connections held by a firm's key executives, it also would be worthy of study to test whether specific governance mechanisms, organizational structure, or resource configurations have an impact on alliance portfolio diversity. The organizational context within which firm-level choices are made surely has an influence on firms' alliance partner selections. Therefore, examining that context could provide an even richer understanding of alliance portfolios.

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