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Alliance Concentration in Multinational Companies: Examining Alliance Portfolios, Firm Structure, and Firm Performance

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Research summary: *This article explores the distribution of alliances across firms' internal structure. Focusing on multinational companies, we examine the impact of alliance portfolio concentration—i.e., the extent to which alliances are concentrated within a limited number of geographic units—on focal firms' performance. Relying on Knowledge-Based View (KBV) insights, we hypothesize that an increase in alliance portfolio concentration positively influences firm performance and that alliance portfolio size negatively moderates this relationship. Our empirical results enrich the emerging capability perspective on alliance portfolios, point to the relevance of conceptualizing focal firms in alliance portfolio research as polylithic entities instead of monolithic ones, and provide new insights into how firms create value by potentially recombining externally accessed knowledge.*

Managerial summary: *In the setting of multinational companies, we examine whether alliance activities are concentrated in a limited number of subsidiaries or are highly dispersed across multiple subsidiaries. We find that, over time, firms exhibit different patterns in terms of alliance portfolio concentration. In addition, the results show that, for MNCs with a relatively small alliance portfolio, an increase in alliance portfolio concentration is positively related to their financial performance. However, when MNCs' alliance portfolios are relatively large, the relationship between alliance portfolio concentration and firm performance becomes negative. Jointly, these findings suggest that the distribution of alliances across firms' internal structure is an important factor in shaping potential knowledge recombination benefits from alliance portfolios.*

Introduction

Alliance portfolios, i.e. firms' collection of direct alliances with partners (Lavie, 2007, p. 1188), are recognized as important strategic phenomena as they provide opportunities for knowledge recombination at both the single alliance level and the alliance portfolio level (Ozcan & Eisenhardt, 2009). Relying on configurational and capability perspectives, scholars have studied how the composition and management of alliance portfolios influences focal firm performance, theorizing that these characteristics shape the knowledge recombination opportunities and abilities of focal firms (Wassmer, 2010).

In this article, we point to the distribution of alliances across focal firms' internal structure as a largely ignored but important factor to explain firms' capability in reaping knowledge recombination benefits from alliance portfolios. Extant alliance portfolio research tends to disregard the internal structure of the focal firm. Aggregating all

Keywords: alliance portfolio; internal firm structure; knowledge recombination; Knowledge-Based View; firm performance
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alliance information to the ultimate parent level, it implicitly conceptualizes the focal firm as a monolithic entity. Instead, we emphasize that firms often consist of multiple, geographically dispersed units, which each can engage in alliance activities. Multinational companies (MNCs), for instance, consist of a group of semi-independent units situated in different geographical locations (Ghoshal & Barlett, 1990). Moreover, subsidiaries in different countries can each engage in alliance activities (Zaheer & Hernandez, 2011), triggering a situation where alliances of MNCs are dispersed across different subsidiaries.

Relying on the Knowledge-Based View (KBV), we theorize that the extent to which alliances are structurally concentrated within a limited number of geographic units influences focal firms' ability to realize the potential knowledge recombination benefits of alliance portfolios. In particular, we hypothesize that increased alliance portfolio concentration—i.e., the extent to which the formation of a firm's strategic alliances is concentrated within a limited number of geographic units of the focal firm—positively influences firm performance. Because of information processing limitations, we expect that this positive effect of increased alliance portfolio concentration becomes less pronounced as the size of the alliance portfolio increases.

To test our hypotheses, we developed a methodological protocol, allowing for the empirical decomposition of alliance portfolios for 32 multinational pharmaceutical firms for the years 2000–2010. Our findings show the relevance and importance of moving away from framing focal firms as monolithic entities, which is the dominant conceptualization in extant alliance portfolio research, toward framing them as polylithic entities, consisting of different units that each can engage in alliance activities. We also contribute to the broader knowledge-based perspective, showing that the distribution of alliances across firms' internal structure substantially shapes firms' ability to recombine external knowledge.

Theoretical Background and Hypotheses

Knowledge-Based View, Alliance Portfolios, and Knowledge Recombination

According to KBV scholars, knowledge is the primary source of value for firms (Grant, 1996). They frame knowledge creation as a recombinant process where firms search for novel or better combinations of different knowledge components (Fleming, 2001; Karim, 2009; Karim & Kaul, 2015). To complement internal knowledge components and to minimize the risk that the existing knowledge base becomes exhausted, firms can form strategic alliances with external partners (Ahuja & Lampert, 2001; Vasudeva & Anand, 2011). Strategic alliances provide firms access to new knowledge elements, allowing to expand the potential set of novel knowledge recombinations (Keil et al., 2008; Vasudeva & Anand, 2011), which can substantially influence firm performance (Jiang, Tao, & Santoro, 2010; Lahiri & Narayanan, 2013). Alliance portfolios can lead to two types of value creating knowledge recombinations. First, there is the possibility of synergistic knowledge recombination at the single alliance level where the knowledge of each individual alliance can be combined with the focal firm's own knowledge (Madhok & Tallman, 1998). Second, focal firms can also engage in synergistic knowledge recombination at the alliance portfolio level where the focal firm recombines knowledge of different alliance partners (Ozcan & Eisenhardt, 2009).

Within extant alliance portfolio research, two different streams of research— i.e., the configurational and the capability perspective (Wassmer, 2010)—are present, which theorize on the knowledge recombination implications of alliance portfolios in different ways. The configurational perspective focuses on how compositional characteristics of the alliance portfolio influence focal firm performance. The core argument of this perspective is that alliance portfolio characteristics such as the number of alliances—i.e., alliance portfolio size—and the heterogeneity of alliance partners—i.e., alliance portfolio diversity—influence the external knowledge pool to which a focal firm has access (Keil et al., 2008; Lee, Kirkpatrick-Husk, & Madhavan, in press; Vasudeva & Anand, 2011), which subsequently shapes focal firms' potential for knowledge recombination at the alliance portfolio level.

The capability perspective, in contrast, focuses on managerial and strategic issues that determine the ability of focal firms to actually reap knowledge recombination benefits from alliance portfolios. The core argument of this perspective is that firms with similar alliance portfolio configurations can still experience substantial

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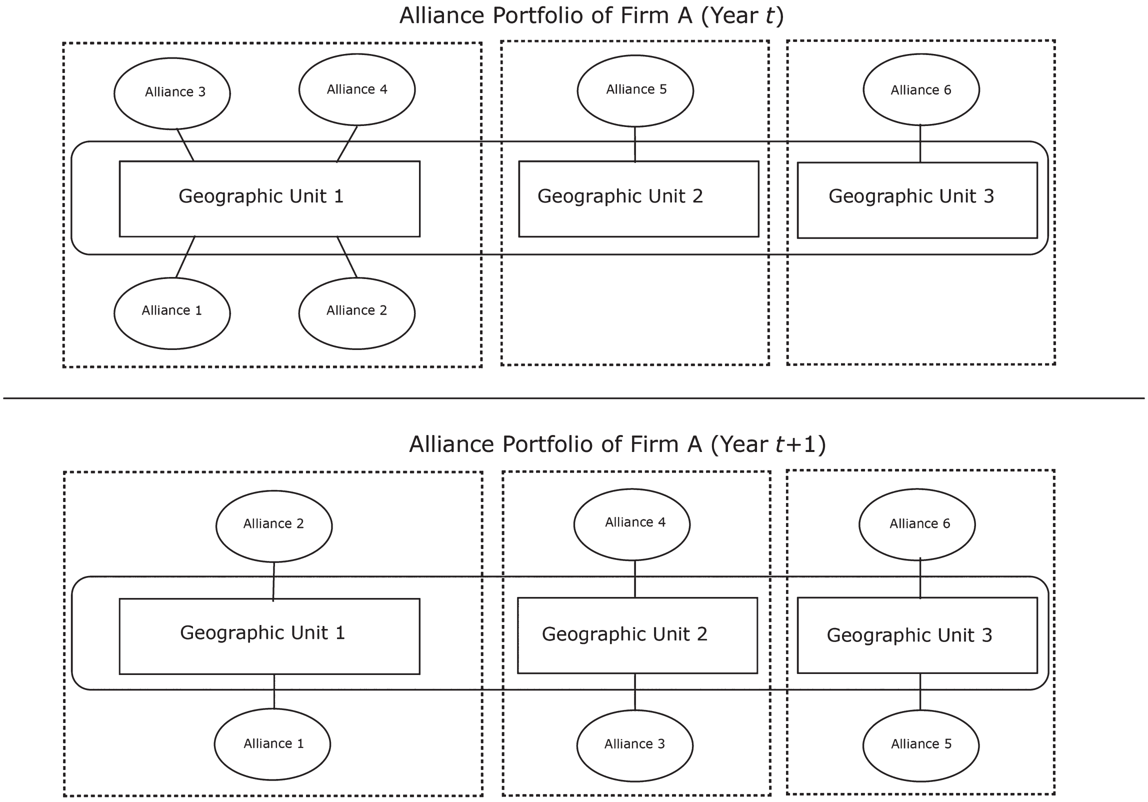

Figure 1. Comparison of two alliance portfolios with similar size but different concentration.

heterogeneity in terms of performance implications (Lahiri & Narayanan, 2013). In this literature stream, a wide variety of alliance portfolio management mechanisms (e.g., dedicated alliance functions, in-house alliance training) are identified that can help firms in realizing synergistic knowledge recombination (Heimeriks, Duysters, & Vanhaverbeke, 2007; Kale & Singh, 2007). In addition, scholars have highlighted the level of internal investments in technology (i.e., level of internal R&D and patenting efforts; Lahiri & Narayanan, 2013; Wuyts & Dutta, 2014) and the vertical integration of downstream or upstream activities (Lahiri & Narayanan, 2013) as strategic choices that foster firms' ability to realize knowledge recombination benefits from alliance portfolios.

Focal Firms' Internal Structure and Knowledge Recombination from Alliance Portfolios

While the alliance literature has identified configurational and capability factors influencing firm performance implications of alliance portfolios, limited attention has so far been paid to the relevance of firms' internal structure. The internal structure of the firm is a key concept in the organization design literature, which studies how firms can optimally manage their activities and resources across different parts of the organization (Galbraith, 1977; Karim, 2012). Further building on the organization design literature, KBV scholars (e.g., Galunic & Rodan, 1998; Karim & Kaul, 2015; Tortoriello, Reagans, & McEvily, 2012) point to firms' internal structure as a core factor that influences firms' ability to successfully engage in knowledge recombination activities. We therefore emphasize the need to explicitly consider firms' internal structure and acknowledge that focal firms often[1] represent polylithic entities, consisting of multiple units that each can engage in alliance

[1] We fully acknowledge that our criticism is mainly relevant for studies that have focused on larger organizations such as MNCs, where the likelihood of geographically dispersed units is higher. Scholars (e.g., Hoehn-Weiss & Karim, 2014) have also studied the alliance portfolios of start-ups and SMEs. For these latter

activities, rather than monolithic entities. To illustrate the importance of firms' internal structure, we show in Figure 1 the alliance portfolios of *Firm A,* consisting of three geographic units, at two different points in time. From a monolithic perspective, *Firm A* has the same alliance portfolio size at both points in time (i.e., a total of six alliances). However, when taking firms' internal structure into account (i.e., polylithic perspective), we can see clear differences in terms of the concentration of the alliances across organizational units. Below, we systematically analyze how the extent to which alliances are concentrated within particular geographic units influences firms' ability to reap potential knowledge recombination benefits from alliance portfolios.

Firm performance implications of alliance portfolio concentration. To recombine knowledge, a first essential step entails the identification of all necessary knowledge components (Galunic & Rodan, 1998). Organizational members tend to search locally for new knowledge combinations rather than considering all potential components and combinations (Kogut & Zander, 1992). When knowledge is concentrated within a limited number of geographic units, the likelihood of failing to identify the necessary knowledge components is lower, facilitating the knowledge recombination process (Carlile & Rebentisch, 2003; Galunic & Rodan, 1998).

Next to identifying the necessary knowledge elements, the KBV points to knowledge transfer as an important requisite for successful knowledge recombination (Carlile & Rebentisch, 2003; Grant, 1996). Organizational units need to coordinate the knowledge recombination process to ensure that the relevant knowledge elements are successfully transferred (Kretschmer & Puranam, 2008). Extant literature (e.g., Minbaeva et al., 2003), studying the transfer of knowledge between different intra-organizational units within MNCs, shows that knowledge transfer between different units is more difficult than within one unit because of the local embeddedness of knowledge (Karim, 2012; Tortoriello et al., 2012) and a strong feeling of identification of the employees with their local geographic unit (Carnabuci & Operti, 2013).

types of firms, a monolithic conceptualization is likely to be less problematic.

Applying these established KBV insights in the context of MNCs' alliance portfolios, we argue that, when the alliances are widely dispersed across different geographic units of MNCs, it is difficult to identify the knowledge elements that can be recombined across different alliances. In addition, the dispersion of alliances across different geographic units also complicates the transfer of different "parts of the puzzle", hampering knowledge recombination at the alliance portfolio level. Such knowledge identification and transfer problems are less likely to emerge in a situation where alliances are concentrated in a limited number of geographic units.

Hypothesis 1: An increase in alliance portfolio concentration is positively related to a focal MNC's performance.

The moderating impact of alliance portfolio size. An established insight in behavioral theory is that "a wealth of information may lead to poverty of attention, thereby resulting in information overload and reducing decision-making effectiveness" (Dobrajska, Billinger, & Karim, 2015, p. 689). KBV scholars therefore stress that, although recombining knowledge within boundaries is easier than across boundaries, there are limitations to the ability of locally recombining knowledge. Individuals are cognitively bound by the number of potential elements and combinations that they can consider simultaneously, which also restricts the likelihood of discovering new knowledge recombinations (Fleming, 2001). Hence, as the locally available knowledge pool increases over time, a tipping point is likely to be reached where it becomes increasingly challenging to identify, assimilate, and exploit the locally available knowledge (Cohen & Levinthal, 1990; Vasudeva & Anand, 2011). Moreover, as the number of relationships in which an organizational actor is engaged goes beyond a certain level, the attention needed to establish and maintain such relations may diminish the ability to absorb knowledge from these relations (Rothaermel & Deeds, 2006). In other words, a situation of attention overload emerges that restricts the ability to engage in knowledge recombination.

Given the existence of such cognitive constraints, we expect that the relationship between alliance portfolio concentration and MNC performance might depend on the actual size of the alliance portfolio. Figure 2 shows the alliance portfolios

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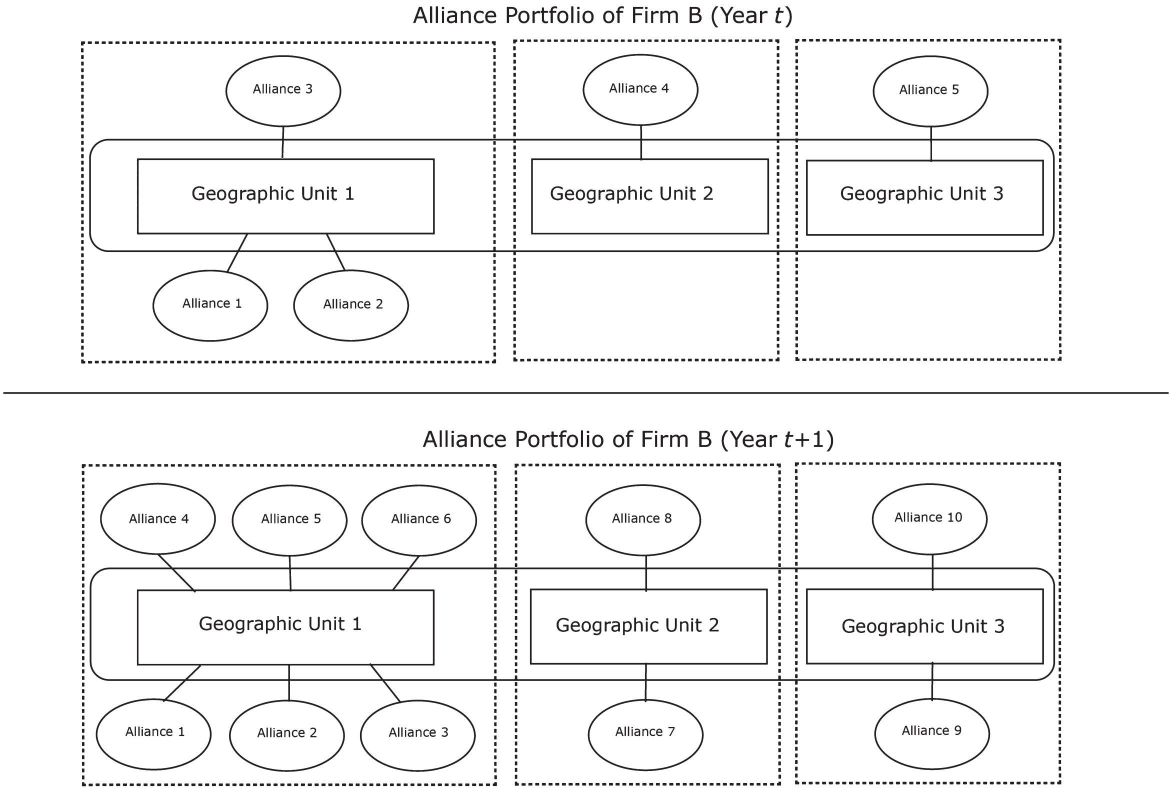

Figure 2. Comparison of two alliance portfolios with different size but same concentration.

of *Firm B* at two different points in time. At both points in time, the portfolio is highly concentrated, where most alliances are formed by Unit 1. However, the size of the alliance portfolio is clearly different. We expect that, at the first point in time, *Firm B* mainly experiences the advantages of alliance portfolio concentration in terms of alliance portfolio knowledge recombination. However, when its alliance portfolio grows in size over time (t+1), we expect that the positive effect of alliance portfolio concentration becomes less pronounced. In this setting, members of Unit 1 are likely to face information processing capacity limitations, restricting the ability to identify and act on knowledge recombination opportunities across alliances. Moreover, given the increased risk of attention overload, realizing knowledge recombination at the single alliance level might also become more complicated. Hence, we hypothesize that:

Hypothesis 2: An increase in alliance portfolio size hampers the positive relationship between alliance portfolio concentration and MNC performance.

Methodology

Data and Sample

To test our hypotheses, we constructed a data set on the internal structure and alliance activities of 32 large, R&D-intensive pharmaceutical firms.[2] In line with the MNC literature (e.g., Ghoshal & Barlett, 1990; Monteiro, Arvidsson, & Birkinshaw, 2008), we conceptualize geographic units as semi-independent organizations in different locations.

To operationalize firms' internal structure of geographic units, we relied on 10-K and annual reports, which typically include a list of a firm's subsidiaries in a particular year. Following prior research (Bouquet & Birkinshaw, 2008), we only included majority-owned or wholly owned subsidiaries, i.e., an ownership share of 50% or more. To create an overview of subsidiaries over time, we

[2] From the "2004 EU Industrial R&D Investment Scoreboard," we initially identified the top 50 R&D-spending pharmaceutical firms. Because of data availability limitations, we were only able to find all the required information for 32 of these firms.

started with the subsidiary list of year $t = 0$ (i.e., the first year a company appeared in our data set) and compared it with the subsidiary list of year $t + 1$. When we observed a change between both lists, for example, if a subsidiary stopped to exist or a new subsidiary appeared, we collected more information to identify the cause of the change.[3] We observed different types of changes. For instance, when new subsidiaries appeared, it could represent a newly created or an acquired subsidiary. Moreover, when a subsidiary disappeared from the list, it could be the result of exiting a market, recombination of units with a potential name change, or dissolution (Karim, 2006). In our sample, some companies resulted from a merger, which we operationalized as a new company.

We relied on the Thomson SDC Platinum database to collect data on firms' alliance activities.[4] As this database specifies the name of the subsidiary that was engaged in forming the alliance, we were able to link particular alliances to specific subsidiaries. Since the information on the termination date is missing for most alliances, we follow existing research in applying a time window of 5 years (Van de Vrande, 2013).[5] After linking each alliance to a particular subsidiary, we calculated for each subsidiary the number of alliances per year.[6]

Dependent Variable

Net profit margin. We rely on *Net profit margin* to measure focal firms' performance. This measure is calculated by dividing the income before extraordinary items by the total sales. Net profit margin is analyzed at $t + 1$, and all explanatory variables are lagged 1 year (i.e., at time t). In line with Jiang et al. (2010), we chose a financial performance indicator instead of an innovation performance indicator (i.e., patent measure) because (a) we aim to highlight knowledge as a strategically significant resource, and (b) we include different types of alliances (manufacturing, marketing, and R&D), which are likely to influence more than just innovation performance.

Explanatory Variables

Alliance portfolio concentration. To operationalize *Alliance portfolio concentration*, we rely on the Gini coefficient, which has extensively been used to measure inequality among values of a frequency distribution (Harrison & Klein, 2007).[7] This measure only includes subsidiaries with operational alliances. When alliance portfolio concentration has a value of 0, alliances are equally dispersed across the subsidiaries that engage in alliance activities, whereas a value of 1 indicates that alliances are concentrated in one subsidiary.

Alliance portfolio size. *Alliance portfolio size* is measured as the sum of all operational alliances of the firm (Jiang et al., 2010). Because the distribution of the number of alliances is highly skewed, we apply a logarithmic transformation.

Control Variables

As control variables we include the *Log-transformed number of employees* to proxy firm size. Second, we include the *Logarithm of the total number of subsidiaries* to control for differences in organizational structure over time. In addition, we control for the *Number of acquired units* to control for the effect of acquisitions on firm performance. We also include firm's annual *Percentage of sales growth per employee* to control for historical performance. Moreover, we control for global market coverage by including the *Change in the number*

[3] We relied on information from additional sources—i.e., LexisNexis and press releases from company websites—to complement and verify the changes in subsidiaries.

[4] In line with Hoehn-Weiss and Karim (2014), we also did an additional check by validating the alliance announcement dates in the SDC database with news articles from the LexisNexis database. The difference between dates across both databases was frequently a small number of days. For a small number of announcements, however, the year of announcement differed across both databases. In this latter case, we applied the announcement date as mentioned in LexisNexis. We also ran analyses without changing the announcement dates, which provided similar results.

[5] We also tested for other time windows. The results remain robust for 4-, 6-, and 7-years-time frames. When we further reduce to a 3-years-time window, the coefficients have the expected signs, but are less significant. A potential explanation may be the reduction in the average alliance portfolio size.

[6] Following Rosenkopf and Padula (2008), and Zhang, Baden-Fuller, and Mangematin (2007), we added the alliances of acquired subsidiaries to the total number of alliances of the firm. Assuming that an alliance lasts for 5 years, only the years in which the focal firm could potentially benefit from the alliances of the acquired subsidiaries were included in the alliance portfolio.

[7] We chose the Gini coefficient because it allows us to measure concentration with respect to disparity (Harrison & Klein, 2007). In contrast, alternative measures such as the Herfindahl or entropy measures reflect variety and are well suited to measure alliance portfolio diversity.

Table 1
Summary Statistics and Correlations

Variable	Mean	Std dev	Min	Max	1	2	3	4	5	6	7	8	9	10	11	12	13
1 Net profit margin	0.12	0.11	−0.60	0.47	1												
2 Firm empl (*ln*)	3.14	1.18	0.70	4.81	0.29	1											
3 Percentage of sales growth per employee	0.04	0.15	−0.68	0.86	0.15	0.05	1										
4 Number of subsidiaries (*ln*)	4.14	1.08	2.08	6.33	0.18	0.77	0.11	1									
5 Number of acquired subsidiaries (*ln*)	0.69	1.09	0.00	5.86	0.04	0.38	−0.10	0.43	1								
6 Change in country locations	0.68	3.63	−16.00	16.00	0.02	0.03	−0.15	0.08	0.32	1							
7 R&D intensity	0.10	0.05	0.02	0.56	0.08	−0.02	0.04	0.05	−0.03	0.01	1						
8 New drug approvals	3.89	9.81	0.00	84.00	0.07	0.11	0.00	0.02	0.25	0.01	−0.15	1					
9 Drug expirations	0.18	0.72	0.00	8.00	0.06	0.24	0.03	0.19	0.14	−0.07	−0.02	0.03	1				
10 Industry munificence	0.04	1.02	−1.02	2.85	0.01	0.06	0.03	0.05	0.19	0.14	−0.01	0.04	0.38	1			
11 Functional alliance portfolio diversity	0.51	0.13	0.00	0.67	−0.02	0.11	0.05	0.04	0.09	0.00	−0.25	0.17	−0.02	−0.10	1		
12 Share of JVs	0.11	0.17	0.00	1.00	−0.24	−0.20	−0.10	−0.11	−0.10	−0.09	−0.28	−0.06	−0.06	−0.11	0.18	1	
13 Alliance portfolio size (*ln*)	2.74	0.86	1.09	4.30	0.30	0.72	0.08	0.65	0.33	0.07	0.08	0.03	0.17	−0.06	0.21	−0.14	1
14 Alliance portfolio concentration across geographic units	0.55	0.30	0.00	1.00	0.10	−0.24	−0.02	−0.19	−0.11	−0.06	−0.06	−0.08	0.00	−0.10	−0.03	0.04	−0.08

Note. All correlations with an absolute value larger than 0.10 are significant at the 0.1% level. $n = 291$.

of country locations in which a firm is active. *R&D intensity*, i.e., the ratio of R&D expenditures and the total sales, is included to proxy changes in the firm's efforts to produce future products and process improvements. We also included *New drug approvals* for each firm in the current year using the Food and Drug Administration (FDA) orange book (Sharma & Lacey, 2004). We control for the *Number of drug expirations* in a particular year using information from FDA's orange book, annual reports, and LexisNexis. To control for *Industry munificence*, we use the database INDSTAT 4 2013 ISI Rev. 3 to create an industry-level variable, which is an index of the number of R&D employees, the number of firms, and total capital formation in the pharmaceutical industry.[8] Finally, we control for *Alliance portfolio diversity* with two different measures (Hoehn-Weiss & Karim, 2014; Jiang et al., 2010). *Functional alliance portfolio diversity* is a Blau index based on the shares of manufacturing, marketing, and R&D alliances. The *Share of joint ventures* is measured as the number of joint ventures divided by the total number of alliances in the portfolio.

Estimation Approach

We apply a fixed effect OLS regression technique,[9] which implies that the interpretation of the results follows the logic of explaining variation within firms over time. The firm fixed effects also account

[8] To construct the industry munificence index, we conducted a principal-component factor analysis using the three pharmaceutical industry variables. The results point to the presence of one common factor (eigenvalue larger than 1). The three individual variables are highly correlated to this index factor.

[9] We conducted a Hausman test to compare the differences between including fixed or random effects. The results of the test show no systematic differences between both effects ($\chi^2 = 28.21$; $p = .1649$). However, the result of the fixed effects regression shows a significant correlation ($\rho = .3498$) between the independent variables and the unobserved firm effects, advocating the use of fixed effects rather than random effects.

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for all time-invariant firm specific characteristics. We include a set of region-year fixed effects to control for macro-economic changes in the different home countries of the firms. The inclusion of these firm and time specific fixed effects also aims to reduce causality issues such as unobserved heterogeneity and potential reversed causality.

Results

Table 1 reports summary statistics and pairwise correlations. Interestingly, the concentration of the alliance portfolio across subsidiaries varies strongly across firms as well as years. A decomposition of the standard deviation into between (firm) and within (firm) variation shows a standard deviation between firms of around 0.25 and a standard deviation over time (within firms) of around 0.18. We also observe that firms of similar size categories vary strongly in the extent to which alliances are distributed across subsidiaries.

Table 2 presents the coefficient estimates (*p*-values in parentheses) for the fixed effects regression analyses. Regarding the control variables, we find in Model I that R&D intensity is

Table 2
Fixed Effects Regression Results (Dependent Variable: Net Profit Margin (t + 1))

Variables	Model I	Model II	Model III	Model IV	Model V
Firm empl (*ln*)	−0.022	−0.021	−0.002	−0.000	0.011
	(.666)	(.673)	(.973)	(.997)	(.816)
Percentage of sales growth per employee	0.062	0.062	0.067	0.067	0.064
	(.208)	(.211)	(.168)	(.171)	(.219)
Number of subsidiaries (*ln*)	−0.007	−0.008	−0.014	−0.015	−0.017
	(.848)	(.838)	(.724)	(.710)	(.662)
Number of acquired subsidiaries (*ln*)	−0.010	−0.010	−0.012	−0.012	−0.012
	(.426)	(.425)	(.335)	(.335)	(.336)
Change in country locations	0.002	0.002	0.002	0.002	0.002
	(.382)	(.384)	(.403)	(.406)	(.567)
R&D intensity	0.300	0.298	0.308	0.306	0.325
	(.000)	(.000)	(.000)	(.000)	(.000)
New drug approvals	0.001	0.001	0.001	0.001	0.001
	(.523)	(.524)	(.604)	(.611)	(.691)
Drugs expirations	−0.010	−0.010	−0.010	−0.010	−0.009
	(.201)	(.203)	(.200)	(.201)	(.258)
Industry munificence	−0.013	−0.013	−0.010	−0.010	−0.010
	(.106)	(.106)	(.247)	(.250)	(.230)
Functional alliance portfolio diversity	0.133	0.133	0.096	0.097	0.103
	(.307)	(.306)	(.455)	(.453)	(.411)
Share of JVs	−0.198	−0.199	−0.190	−0.191	−0.188
	(.043)	(.046)	(.066)	(.068)	(.053)
Alliance portfolio concentration across geographic units		0.005		0.008	0.172
		(.856)		(.764)	(.059)
Alliance portfolio size (*ln*)			0.037	0.038	0.078
			(.034)	(.035)	(.006)
Alliance portfolio size (*ln*) × alliance portfolio concentration across geographic units					−0.070
					(.031)
Constant	0.149	0.145	0.026	0.019	−0.107
	(.437)	(.436)	(.906)	(.930)	(.644)
Firm fixed effects	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes
R-squared (within)	0.185	0.185	0.203	0.203	0.214

Note. Fixed effects regression with p-values in parentheses below the estimated coefficients. The models are estimated using robust standard errors. All regressions include a full set of region and year dummy interactions which are not reported for brevity. The respective regions are United States, Japan, and Europe. The total number of firm-year observations is 291 (32 firms with an average of 9.1 yearly observations).

positively and significantly related to firm performance (95% CI = [0.162 0.437]), whereas the share of joint ventures is negatively and significantly related to firm performance (95% CI = [−0.390 −0.007]). The coefficients for the remaining control variables are insignificant, but have the expected signs. Model IV shows that the direct effect of alliance portfolio size is positive and significant (95% CI = [0.003 0.072]), whereas the direct effect of alliance portfolio concentration on firm performance is nonsignificant (95% CI = [−0.047 0.063]). Model V provides support for Hypothesis 2, showing that alliance portfolio size negatively moderates the relationship between alliance portfolio concentration and firm performance (95% CI = [−0.133 −0.007]).

Figure 3 displays the marginal effects of alliance portfolio concentration on firm performance for different levels of alliance portfolio size. We find that, when firms have relatively small alliance portfolios (i.e., less than five alliances), alliance portfolio concentration exhibits a positive relation with firm performance. For instance, for firms with a small portfolio (e.g., four alliances), one standard deviation increase in alliance portfolio concentration (i.e., 1 SD = 0.30) increases firms' net profit margin with 2.24 percentage points. However, when firms' alliance portfolio increases to a relatively large alliance portfolio (i.e., more than 26 alliances), alliance portfolio concentration is found to reduce firm performance. For firms with a large portfolio (e.g., 40 alliances), one standard deviation increase in alliance portfolio concentration decreases financial performance with 2.59 percentage points. While portfolio concentration seems to matter most in the tales of alliance portfolio size, we observe that, for medium-sized portfolios, neither positive nor negative effects of alliance portfolio concentration dominate.[10]

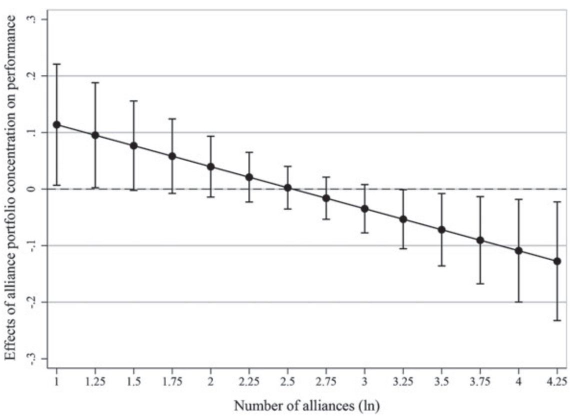

Figure 3. Average marginal effects of alliance portfolio concentration for varying sizes of alliance portfolios.

Discussion

Implications for the Alliance Portfolio Literature

Several alliance portfolio scholars (e.g., Wassmer, 2010) have called for a more in-depth theoretical understanding of the knowledge recombination implications of alliance portfolios. Some scholars have started addressing this call, examining alliance portfolio interdependencies (Wassmer, Li, & Madhok, 2017) and how they are distributed across partners (Hoehn-Weiss, Karim, & Lee, 2015). In this article, we complement these research efforts by moving away from framing focal firms as monolithic entities, which has been the dominant conceptualization in extant alliance portfolio research. Instead, we conceptualize the firm as a polylithic entity and introduce the new concept of alliance portfolio concentration, allowing us to demonstrate that the distribution of alliances across firms' internal structure substantially influences firms' ability to recombine knowledge from its alliance portfolio. In this way, we identify an additional factor shaping the capability of firms to reap the potential knowledge recombination benefits of alliance portfolios.

We also see several avenues for future research in this respect. First, whereas we focused on disentangling the internal structure of the firm, making a distinction between geographic units, future research could also consider the extent to which these units are connected to each other and how such connections impact alliance portfolio knowledge recombination activities. Research on knowledge transfer in multinational (Frost & Zhou, 2005) and multilocation firms (Alcácer & Zhao, 2012) has provided evidence that the presence of strong linkages between units substantially increases their ability to transfer knowledge. Based on these insights,

[10] To test the robustness of our results, we conducted additional analyses using an alternative definition of alliance units, return on assets as a dependent variable, and the operationalization of alliance portfolio concentration with a Herfindahl-Hirschman Index (HHI). The results were highly similar. We have also considered nonlinearities between alliance portfolio size and firm performance. Adding a squared term for alliance portfolio size turns out to be insignificant.

we expect that higher internal embeddedness might help to reduce the potential disadvantages of having an alliance portfolio that is geographically dispersed across firms' internal structure.

Second, whereas focusing on geographic boundaries was highly relevant in our particular context, it might be less relevant in other settings such as start-ups and SMEs (Hoehn-Weiss & Karim, 2014). However, alternative internal boundaries can also be present in these latter settings. For example, in the new product development literature, scholars (e.g., Olson, Walker, & Ruekert, 1995) point to the existence of functional boundaries—i.e., clear differentiation between R&D, manufacturing and marketing units—as an important hampering factor, restricting knowledge recombination within firms. Exploring the impact of such alternative internal boundaries is therefore relevant.

Implications for the Knowledge-Based View

KBV scholars emphasize that corporate restructuring can substantially influence firms' ability to recombine internal knowledge. Karim and Kaul (2015), for instance, demonstrate that, under certain boundary conditions, structural recombination of business units allows firms to realize untapped knowledge synergies within the firm. Corporate restructuring, however, can also lead to a redistribution of alliances within the focal firm. Merging different geographic units, for instance, can substantially increase alliance portfolio concentration. Our study shows that, in case of relatively small alliance portfolios, this is likely to increase the ability to recombine knowledge from the alliance portfolio, whereas it can trigger alliance portfolio recombination problems when the alliance portfolio is relatively large. From a managerial perspective, these findings indicate that, when managers consider corporate restructuring, they should also take into account the repercussions for firms' alliance network.

Another important concept in the KBV is absorptive capacity. In alliance portfolio research (e.g., Vasudeva & Anand, 2011; Wuyts & Dutta, 2014), absorptive capacity is used as a firm-level construct that helps to explain why some firms are more able to learn from external partners than others. At the same time, studies on MNCs (e.g., Minbaeva et al., 2003; Schleimer & Pedersen, 2013) extensively studied absorptive capacity at the subsidiary level, examining factors that determine why some subsidiaries are more able to learn from other subsidiaries or headquarters. Whereas these different literature streams have focused on absorptive capacity at the firm level *or* the subsidiary level, our findings point to the need for considering the linkages between these different levels. In particular, we emphasize that the ability to reap financial benefits from alliance portfolios at the firm level may depend on the absorptive capacity of their subsidiaries. For instance, we find strong indications that, in case of a large alliance portfolio, alliance portfolio concentration can lead to a situation where some subsidiaries are facing a problem of alliance overload. This overload creates a gap between potential and realized absorptive capacity (Zahra & George, 2002) at the subsidiary level, negatively influencing firms' financial performance. Such problems of subsidiary alliance overload are less likely to emerge when firms have a more dispersed alliance portfolio.

Limitations and Future Research

This study faces several limitations, which also provide interesting avenues for further research. First, the setting of our study is limited to large, R&D-intensive firms in the pharmaceutical industry, restricting generalizability of our findings. Second, following other recent alliance portfolio studies (e.g., Jiang et al., 2010; Zaheer & Hernandez, 2011), we relied on the Thomson SDC Platinum database to collect alliance information, implying that our coverage of alliances may not be complete. Finally, because of data availability problems, we could also not take into account how alliance portfolios are actually managed. Alliance portfolio management scholars (e.g., Sarkar, Aulakh, & Madhok, 2009) have already pointed to the potential moderating effect of alliance portfolio management mechanisms. We therefore encourage future research to examine how alliance portfolio management decisions moderate the performance implications of alliance portfolio concentration.

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