

# Academic spin-offs' team heterogeneity: an exploratory analysis on growth performance

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## Abstract

**Purpose of the paper:** *The present study seeks to shed light on the relationship between team background diversity and growth performance in academic spin-offs. Academic spin-offs are an important means to exploit and transfer the results of academic and scientific research. However, empirical investigations highlight that they tend to have more homogeneous teams and lower performance than independent new ventures.*

**Methodology:** *We focus on the disciplinary background of academic and non-academic members in order to assess the team heterogeneity. The sample is composed of 67 academic spin-offs. Hierarchical regression analysis has been used for our exploratory purpose.*

**Findings:** *The results show that the functional diversity affects positively firm growth and this impact is significantly higher in the case of corporate venture backed spin-offs. Moreover, our findings suggest that the integration of market-oriented skills and business-related networks and competencies through the presence of CVC strengthen the relationship between heterogeneity and performance.*

**Implications:** *A growing body of literature shows that functional diversity is more likely to have positive effects than demographical diversity. Our results confirm the key role of a balanced composition between academic and non-academic profiles. Furthermore, this functional heterogeneity can be fruitfully extended by external market capabilities conveyed by the presence of a corporate venture capital.*

**Originality of the paper:** *This exploratory study is a first attempt to fill the gap on the relationship between diversity and performance. The originality of the analysis lies in deepening the interaction between team functional background and corporate venture in assessing the performance of academic spin-offs.*

*Key words: team heterogeneity; academic spin-off; corporate venture capital*

## 1. Introduction

Academic Spin-Offs (ASOs) emerge out of a university or a research institute as a means of potential value generation from a scientific research (Clarysse *et al.*, 2005; Visintin and Pittino, 2014). Research-based knowledge, which is exploited and transferred through the creation of a new venture, lies at the core of ASOs. Despite the potential role in providing a link between science and industry, a growing body of empirical research highlights their relatively low performance rate (Wennberg *et al.*, 2011; Ensley and Hmieleski, 2005). Most of the existing contributions dealing with

resources and capabilities that favour (or hinder) the growth of ASOs has demonstrated that the composition of the entrepreneurial founding team is a key factor (Visintin and Pittino, 2014). While technological resources are usually in place, the quality of the entrepreneurial/managerial group seems to be one of the most critical issue for the growth of ASOs (Moray and Clarysse, 2005). Drawing from studies on team functional diversity (Tekleab *et al.*, 2016; Visintin and Pittino, 2014), this study attempts to shed more light on the link between team functional heterogeneity and ASOs' performance.

The key question of diversity research is still unresolved, since there are ambiguous results on the effects of group members' diversity linked to performance. Some scholars have found out that demographic diversity, in terms of personality, values and attributes, has negative effects on group performance, while functional diversity is more likely to have positive effects (Van Knippenberg and Schippers, 2007; Van Dijk *et al.*; 2012). ASOs represent an interesting field for this analysis, since, at the time of foundation, they tend to have more homogeneous functional background than independent start-ups (Ensley and Hmieleski, 2005, Mustar *et al.* 2006) and a worse performance (Wennberg *et al.*, 2011; Ensley and Hmieleski, 2005).

In this study, firstly, we contribute to the debate on ASOs by evaluating the predicting role of team heterogeneity on ASOs' growth performance. To do that, we measured functional diversity as the sum of team members' different backgrounds, taking into account the disciplinary differences in academic research competencies of the team composition, among the distinction between academic research competencies and non-academic market-based competencies. Secondly, since heterogeneous academic top management teams often lack effective market knowledge and market orientation, we consider Corporate Venture Capital (CVC) as a factor that can provide academic entrepreneurs with a wide range of market connections and competencies, which are typically unavailable for teams formed exclusively by academic researchers (Rasmussen *et al.*, 2011). Therefore, we assessed whether and how CVC-backed ASOs can enhance their likelihood to grow. The article proceeds as follow. The next section presents the theoretical background, first focusing on the concept of diversity and the relationship between team heterogeneity and performance; then the characteristics of ASOs' team and the importance of competencies heterogeneity are explored. The third section describes the methodology, while the fourth section detailed the variables used. The fifth section outlines and discusses the results. The study's implications, limitations and potential avenues for future research are also presented.

## **2. Background**

The heterogeneity construct is rooted into the sociological and organisational literature. In such domains, "diversity" rises as a perception that someone is different from the self, due to differences related to some kind of attributes; and there are different perspectives under which these

differences may be investigated (Van Knippenberg and Mell, 2016). Trait diversity defines the attributes composition of a group, either demographical (i.e. gender, age, ethnicity, and tenure) or functional (i.e. educational and functional background), and it is the most common type of group diversity investigated (Williams and O'Reilly, 1998; Chowdhury, 2005; Van Knippenberg and Schippers, 2007). Into the organizational literature, the social categorization theory and the similarity attraction perspective argue for the positive effect of group trait homogeneity on performance, while diversity may have negative effects on group processes, and consequently on performances (Williams and O'Reilly, 1998). Conversely, the information/decision-making paradigm emphasizes the positive effects of group trait diversity on performance. In line with this latter view, people with different opinions and characteristics may contribute to increase the group resources, since they provide a broader range of task-relevant knowledge, skills and abilities (Williams and O'Reilly, 1998).

Looking at the managerial literature on new venture team diversity, the vast majority of the contributions is based on the upper echelon theory as the primary lens through which evaluating new venture team functioning and performance (Klotz *et al.*, 2014). This perspective associates the top management team characteristics and behaviours to the teams' outcomes and performances (Hambrick, 2007). Demographic and functional attributes are summed up in order to assess the degree of heterogeneity within a team (Klotz *et al.*, 2014). Consequently, the minimum heterogeneity occurs when all the individuals belong to the same category, while the maximum heterogeneity refers to the richest distribution of individuals among the possible categories of attributes (Harrison and Klein, 2007). The relationship between heterogeneity and performance is not clear under a trait diversity conceptualization, since researches show mixed results (Klotz *et al.* 2014; Ensley and Hmieleski, 2005) or non-significant relationship (Chowdhury, 2005). In line with the mainstream, we analyse the heterogeneity of team members under a trait diversity perspective, focusing our attention on the top management team of academic spin-offs. According to Klotz *et al.* (2014), the top management team differs from the early entrepreneurial team because, in the former, the roles are clearly defined on specific functional titles that lack in the latter, but both define conceptually the same group of individuals in charge of the strategic decision-making of the venture.

University-based or academic spin-offs are a particular category of new venture. They are founded by a university or a research institute in order to market technologies or discoveries developed within an academic and scientific frame (Mustar *et al.* 2006; Rasmussen *et al.*, 2011). According to some authors, the different origin of academic spin-offs leads to differences in team composition (Ensley and Hmieleski, 2005, Mustar *et al.* 2006). Evidences also suggest that academic spin-offs do not perform as well as independent start-ups (Wennberg *et al.*, 2011; Ensley and Hmieleski, 2005). Drawing mainly on the resourced-based view of the firm (Barney, 2001), there is consensus on the fact that the founders' functional and educational background is a good explanation of the initial pool of competencies and that in academic spin-offs the backgrounds' variety tend to be more

homogeneous than in independent start-ups (Ensley and Hmieleski, 2005; Mustar *et al.* 2006). Over time, it is likely that the original entrepreneurial team could change, due to high pressure for integrating research and market competencies within the team and thus improving performances (Vanaelst *et al.*, 2006; Rasmussen *et al.* 2011). A certain degree of functional diversity seems to be desirable also for ASOs (Heirman and Clarysse, 2004), since it can result in a better integration of market-related skills and business-related networks with technical competencies (Vohora *et al.*, 2004; Visintin and Pittino, 2014). Researchers demonstrate quite clearly that the integration of academic and non-academic profiles plays an important role for the survival and the growth of academic spin-offs (Visintin and Pittino, 2014; Rasmussen *et al.*, 2011). For example, Visintin and Pittino (2014) prove that the integration of academic and non-academic members positively affects team performance in terms of sales and employments growth. Similarly, Tekleab *et al.* (2016) demonstrate that high levels of functional diversity within a team can facilitate team performance, under the condition that cross-functional teams have a significant degree of behavioural integration. In line with these studies, we want to explore whether and how the team heterogeneity, in terms of different domain of academic and non-academic knowledge, affect the likelihood of growth in ASOs. In doing so, we focus on the individuals' background and on the variety of the disciplinary specialization of the academic members. The assumption is that academic teams with different disciplinary backgrounds have different cognitive orientations that, in turn, may influence positively team interaction and effectiveness (Visintin and Pittino, 2014).

In addition to this, a deeper understanding on the integration of different competencies and backgrounds is needed, and specifically on the capacity to involve industrial partners (Mustar *et al.* 2006). In line with this, we investigate the role of corporate venturing as a mean to access business experience. According to Narayanan *et al.* (2009 p. 59), corporate venturing is "the set of organizational systems, processes and practices that focus on creating businesses in existing or new fields, markets or industries using internal and external means. Internal means typically include innovation and new business incubation. External means usually include licensing, joint venturing, acquisitions, and corporate venture capital". In particular, when related to ASOs, Corporate Venture Capital (CVC) is an equity investment made by a non-financial corporation with the aim, capital gains apart, to create value for the corporate parent (Dushnitsky, 2006) through the access to innovative technologies and ideas that spring out from the academic context. In fact, innovations developed by venture-backed ASO can supplement the activity of a corporate investor's internal R&D and stimulate demand for new products. From the ASO's perspective, the relationship with industrial partners through CVC facilitates the access to network of ties with potential suppliers, customers, and other critical stakeholders. In such a way, CVC provides access to new information and significantly affects ASO's ability to discover and exploit new markets and technological opportunities (Benson and Ziedonis, 2009). In our view, CVC represents a mean through which market competencies can complement ASOs' R&D capabilities. Thus, we want to explore its direct

effect on a new venture's capacity to grow and, given its supposed impact on a firm's coordination capabilities, also its moderating effect on the relationship between team heterogeneity and new venture growth.

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### 3. Methodology

Our sample is made of academic spin-offs based in the Emilia Romagna region, extrapolated from the officially listed Italian academic spin-offs in the directory of the NETVAL network<sup>1</sup>. By definition, at the time of foundation an ASO has either the university among the founding shareholders or at least one academic profile (Visintin and Pittino, 2014). We traced back the team composition and the members' background using secondary sources of information (Netval, MIUR/CINECA, University websites, LinkedIn, Researchgate), including the information about the specific academics' research area based on the official classification of the Italian National University Council (CUN). Diversity in functional backgrounds is thus the sum of attributes linked to the disciplinary academic backgrounds and the non-academic background of team members.

For our exploratory purpose, we collected data on 73 spin-offs: we analysed 67 ASOs founded in the period 2000-2010. The sample is self-selected due to limited information. In fact, the NETVAL database does not specify the team composition for all the ASOs listed. We also excluded 7 ASOs founded after 2011 due to data constraints in the computation of the dependent variable.

For each of the 67 ASOs we analysed the current composition of the top management team, which is the group of people in charge of the strategic decision-making of the venture, information available from both NETVAL and AIDA databases. The information were then codified in categorical and dummy variables, in order to assess the degree of heterogeneity and to perform a hierarchical regression analysis.

### 4. Measurements

#### 4.1 Dependent variable

The most common outcome variables used in new venture team literature are linked to the firm-level performance, such as growth in sales, profitability and number of employees (Klotz *et al.*, 2014); while only in few cases variables linked to team-level performance are used, such as team effectiveness (Chowdhury, 2005). In line with the vast majority of the studies, we choose the growth in sales as dependent variable. Although most studies focus on the formation of academic spin-offs and not their subsequent performance (Wennberg *et al.* 2011), we try to figure out the performance of an ASO by looking at the sales growth from the third year to the fifth year after the foundation.

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<sup>1</sup> NETVAL is the network of universities engaged in technology transfer activities.

#### 4.2 Independent variable

*Firm Heterogeneity.* We look at the background of each team member in order to differentiate between academic and non-academic profiles. Furthermore, we search for the disciplinary background of the academic profiles. The heterogeneity (Team\_Het) is thus defined as the sum of different disciplinary specializations of academic members, based on specific competencies in a research area, added to the industry's competencies possessed by non-academic members. The independent variable is evaluated for each team computing the Blau Index, which assesses the distribution of individuals among the possible categories (Budescu and Budescu, 2012). The categories considered in this study are as follow: industry and market knowledge and competencies, which we assume to be always related to a non-academic profile; and four types of research competencies associated to academic profiles, namely: mathematical, chemical and information technology competencies; biological and medical competencies; engineering competencies; humans and economics sciences competencies.

*CVC.* We create a CVC dummy variable which equals 1 when ASOs raise financing from a CVC investor and 0 for their peers without such financing. Further, we calculate the interaction between firm heterogeneity and CVC dummy to study whether the relationship between team heterogeneity and growth is moderated by the presence of CVC.

#### 4.3 Control Variables

We control for origin, year, and team's demographic effects. Origin is measured by dummy variables that represent the University from which the spin-off has originated. Firm age is measured as the number of years since formal establishment. We also control for team effects. Team size is measured as the total number of members of the team. We also control for the quadratic effect of team size. Team diversity is further analysed in terms of both gender and foreignness diversity. Equity share held by the university is a dummy variable (UNI\_01) that approximates the level of embeddedness of the ASO's team in the network of university-based relationships. VC\_01 is a dummy variable that equals 1 when ASOs raised financing from a VC investor.

### 5. Results

Table 1 provides an overview of the means, standard deviations, and correlations between the variables.

Tab. 1: Descriptive Statistics

Variable	Obs	Mean	Std. Dev.
UniFe	67	.136	.346
UniBO	67	.500	.504
UniPR	67	.197	.401
UniMORE	67	.167	.376
Uni_01	67	.318	.469
Firm_Age	67	1.028	2.606
VC_01	67	.091	.290
Team_Gender	67	.591	.495
Team_Foreign	67	.076	.027
N_Team	67	4.545	2.888
Team_Heterog	67	.275	.239
CVC_01	67	.545	.502

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Source: Authors' elaboration

For our exploratory purpose, we chose a hierarchical regression analysis. The control variables have been included in the first model; independent variables have been entered in the second model; interaction effect has been included in the third model (see Table 2). To check for multicollinearity issues, we computed the variance inflation factor (VIF) for each explanatory variable. Since VIF values were well below the recommended cut-off point of 4, multicollinearity is not a major concern.

Tab. 2: Hierarchical Regression Model

Dependent Variable: Sales Growth	Model 1		Model 2		Model 3	
	Coef.	Rob. Std. Err.	Coef.	Rob. Std. Err.	Coef.	Rob. Std. Err.
Constant	1.227	0.571	0.967	0.434	1.132**	0.424
UniBO	-0.015	0.271	-0.079	0.273	-0.102	0.267
UniPR	-0.012	0.252	-0.067	0.258	-0.106	0.258
UniMORE	0.018	0.315	-0.027	0.340	-0.084	0.330
Uni_01	0.044	0.223	-0.109	0.283	-0.188	0.256
Firm_Age	-0.082**	0.045	-0.073*	0.040	-0.069*	0.036
VC_01	-0.308*	0.174	-0.458*	0.254	-0.527*	0.280
Team_Gender	-0.036	0.149	0.003	0.145	0.052	0.133
Team_Foreignness	-0.109	0.155	-0.183	0.166	-0.164	0.171
N_Team	0.017	0.03	-0.003	0.028	-0.017	0.030
N_Team^2	-0.006	0.005	-0.005	0.005	-0.005	0.004
<i>Independent Variables</i>						
Team_Het			0.541*	0.368	0.108	0.306
CVC			0.210	0.204	0.245	0.185
<i>Interaction Effect</i>						
Team_HetxCVC					1.306**	0.610
R-squared	0.183		0.232		0.299	
Obs.	67		67		67	

\* p<.05; \*\* p<.01

Source: Authors' elaboration

In the first model, the control variables explain 18,3% of the amount of variance in sales growth. Only firm age and VC are significant (with negative signs). In the second model, we found that firm heterogeneity has a positive influence on sales growth while the presence of CVC, as main effect, is not significantly associated with the ASOs' growth. In the third model, we added the interaction term to test the moderator effect of CVC. We found that CVC significantly moderates the heterogeneity-growth relationship. This means that the effect of background diversity on firm growth is significantly higher when there is the presence of a corporate venture in the entrepreneurial team.

## 6. Conclusion

The paper presents an exploratory analysis that aims to contribute to the study of the relationship between heterogeneity and performance, looking at the specific case of ASOs. Our results extend prior knowledge about the appropriate composition of ASOs' team and the integration of market-related skills and business-related networks with academic technical and research competencies (Vohora *et al.*, 2004; Visintin and Pittino, 2014).

Based on an original collection of data about ASOs' team and team members' background, the analysis confirms that a certain degree of functional diversity fosters the growth performance. We thus contribute to the debate on the theme by offering new empirical evidence about the importance of the integration of academic and non-academic profiles for the survival and the growth of ASOs (Tekleab *et al.*, 2016; Visintin and Pittino, 2014; Rasmussen *et al.*, 2011). Moreover, our findings suggest that the integration of market-based competencies and business-related networks through the presence of CVC strengthens the relationship between heterogeneity and performance. In fact, in our model the effect of background diversity on firm growth is significantly higher when there is the presence of a corporate venture within the team. In line with Benson and Ziedonis (2009), results suggest the key role of CVC in supporting the exploitation of a combined set of technological and market opportunities, so stretching the potential value of ASOs' original resources and competencies.

In our sample, a balanced composition between academic and non-academic profiles resulted to have relevant implications for ASOs. In line with the information/decision-making paradigm, we confirm the positive effects of team trait diversity, and more specifically functional diversity, on growth performance. Team members with different backgrounds and specialization provide a broader range of task-relevant knowledge, skills and abilities (Williams and O'Reilly, 1998), improving the growth performance of ASOs. Moreover, we highlight the key role of that particular set of market-based competencies that can be brought about by CVC. Our main contribution lies in suggesting a positive moderation effect of CVC on the heterogeneity-growth relationship. As a managerial implication, academic entrepreneurs have to be aware of the role of market-based competencies in fostering their venture growth and of the mechanisms they can use to integrate them within the top management team.

The results and the possible implications of the study are limited by its exploratory nature and the limited sample size. Moreover, the methodology is susceptible of further refinements, with regard both to possible constraints related to the index adopted to measure heterogeneity, and to the robustness of the categorical variables used to represent the heterogeneity of academic competencies. Along these improvements, we believe that extending the research design to a national sample would lead to more reliable results. Additionally, since the team is subject to changes over time, it would be insightful to collect information on the pool of competencies within ASOs at different time lapses and assess how the turnover of team members with different background may foster or hinder growth performance. Finally, the robustness of results could improve by extending the data collection on a multi-country sample of ASOs as to evaluate if differences in national university systems may affect the integration between academic and non-academic profiles.

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