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Academic entrepreneurship: founding and governance determinants in university spin-off ventures

Mauro Sciarelli¹ · Giovanni Catello Landi^{1,2} · Lorenzo Turriziani¹ · Mario Tani¹

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Abstract

Academic research is generally seen as one of the most important goals of a university, but universities are being called upon simultaneously to assist in building a local entrepreneurial ecosystem and contributing to economic growth. Universities can be the source of startups based on academic research results and thereby influence a given industrial context. This paper investigates the impact of academic entrepreneurship on the economic performance of university spin-offs (USOs) and, in particular, how the composition of the founding team, the diversity of academic ownership, CEO duality, and the presence of women on the board of directors affect USO success. We study these relationships with a cross-sectional sample of 136 firms in southern Italy. Our findings highlight that governance and ownership can influence various indicators that are often used for measuring enterprise success in different ways and that, based on the specific success metrics, managers or policymakers should consider different aspects to better understand a USO's potential for success.

Keywords Academic diversity · CEO duality · Founding team · Southern Italy · University spin-off

JEL Classification L26 · M13 · O32

1 Introduction

Increasing the role of universities in local economic growth has been widely recognized as a strategy for engaging stakeholders more deeply in university technology transfer (Mian 1997; Zucker et al. 1998; Di Gregorio and Shane 2003; Audretsch 2014) and to create the conditions for economic exploitation of intellectual property, tacit knowledge, and academic research (Goldstein 2010). Creating new business entities, in the form of

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university spin-offs (USOs), is an effective way for universities to contribute to local development in response to their lack of financial resources by cooperating with private firms (Cohen et al. 1998). USOs are increasingly recognized as effective drivers of regional and national competitiveness because of their potential ability to foster economic activity (Di Gregorio and Shane 2003; Nicolaou and Birley 2003), create employment in science-based sectors (Conceição et al., 2012; Breznitz and Anderson 2006; Clarysse et al. 2005; Di Gregorio and Shane 2003; O'Shea et al. 2008; Shane 2004; Slater and Mohr 2006), and create linkage between industry and science (Debacker and Veugelers 2005; Perez and Sánchez 2003).

However, the empirical evidence shows that, on average, academic business ventures do not outperform their non-academic counterparts (Zahra et al. 2007; Wennberg et al. 2011; Ortìn-Ángel and Vendrell-Herrero 2014) rather, these ventures usually remain small (Mustar et al. 2008). Therefore, it could be useful to identify the factors that might improve USO business growth and financial performance.

In evaluating these characteristics, the prior literature has analyzed the scientific progress of academic research (D'Este and Perkmann 2011; Fini et al. 2009); the value added by support and scouting activities from a technology transfer office (TTO) (Algieri et al. 2013; Lockett et al. 2005); the effect of the composition of the founders, i.e., the background of the USO promoters (Clarysse and Moray 2004; Grandi and Grimaldi 2003; Knockaert et al. 2011); the equity owned by the parent university (Colombo et al. 2010; Rasmussen and Borch 2010); and the main USO characteristics at the initial growth phase (Iacobucci et al. 2011).

Although entrepreneurial capabilities have been widely recognized as effective drivers of economic success for USOs (Colombo and Grilli 2010; Newbert et al. 2008), only a few studies have investigated the financial growth of USOs in conjunction with founding team heterogeneity and the characteristics of the top management (Visintin and Pittino 2014; Mustar et al. 2006; Prencipe 2016). Indeed, according to the resource-based view (RBV) (Barney et al. 2001), the heterogeneity of human capital resources (Pazos et al. 2012) and the involvement of academic and nonscientific actors in managerial decision-making (Colombo et al. 2014) should create a competitive advantage in USOs' rapidly changing knowledge- and technology-driven markets. Thus, we assume that by their very nature, USOs need to properly balance their scientific and business orientations. A scientific orientation is necessary for the process of discovery and early technology development, whereas a business orientation is required for effective commercialization of products and services that incorporate that technology (Kassicieh et al. 2002). If we apply this perspective to the structure and composition of USO entrepreneurial teams, we can understand some of the characteristics of these ventures.

Our study aims to fill this research gap, analyzing the impact of founding team heterogeneity and USO governance models on the financial performance of USOs. Specifically, we look at the effects of a heterogeneous founding team in terms of academic and non-academic founders on spin-off success. Additionally, considering the influence of universities, firms, and foundations on performance, we take into account both CEO duality (the same person is the CEO and the chairman of the board) and the involvement of women on the board.

To test the influence of these factors, we selected all 136 active USOs in southern Italy from the Netval database (2018), which includes information on the number of spin-offs generated by all Italian universities. We considered both pure and hybrid USOs. The former have only academic founders, the latter exhibit the joint presence of academic and non-academic founders. We focus on southern Italy, because it is usually seen as a less

developed region, where spin-offs and small firms have greater difficulty in succeeding (Algieri et al. 2013).

We found that CEO duality, i.e. the practice of a single individual serving as both CEO and board chair (Krause et al. 2014), can help enhance the likelihood of USO success in terms of sales and profitability. The main contribution of this paper is in conducting a systematic analysis of all USOs established in southern Italy, in terms of the human capital determinants that foster academic entrepreneurship.

The remainder of the paper is organized as follows: Sect. 2 provides the theoretical framework; in Sect. 3 we develop the research hypotheses; in Sect. 4 we describe the variables, methods, and results of our analysis; Sect. 5 presents the main limitations of this work, suggesting opportunities for further research; finally, in Sect. 6 we conclude the paper, discussing our findings and offering some final remarks.

2 Review of the literature

2.1 Academic entrepreneurship and university spin-offs (USOs)

Many studies have argued that high-ranking scientists at academic institutions create spin-off firms to gain returns from their knowledge capital and research results (Smilor et al. 1990; Zucker et al. 1998; Mustar et al. 2008). Several researchers (Vohora et al. 2004; Clarysse and Moray 2004) have found that USOs operate in a different context, as the founding team comes from a non-market-based environment in which technical skills are more relevant than business skills (Visintin and Pittino 2014). Indeed, academic founders focus on highly innovative products and services, allowing USOs to create a new market where entrepreneurs can benefit from first-mover advantage (Heirman and Clarysse 2004). However, academics are unfamiliar with the business environment, and, consequently, their ventures may have lower performance than their non-academic counterparts (Shane 2004). Moreover, their commitment to science may conflict with their entrepreneurial vision (Jain et al. 2009), especially when academic and business activities overlap or when research and venture interests diverge. As a consequence, academic founders often collaborate with external entrepreneurial actors to gain access to their relevant managerial resources, skills, and capabilities (Clarysse and Moray 2004; Mustar et al. 2006; Renders et al. 2010; Colombo and Piva 2012; Visintin and Pittino 2014).

USO founders with a business-oriented mindset are critical human resources for a science-based startup (Grandi and Grimaldi 2005), in which the core activities involve an underlying research project or scientific knowledge (Rothwell 1992; Schmookler 1966). Studies on USOs have highlighted that CEO managerial skills, financial resources, and industrial partnerships are critical assets in their development (Bianco and Casavola 1999; James 1999; Packalen 2007; Renders et al. 2010). USOs are high-technology ventures, lack strong commercial support in their startup phase (Vohora et al. 2004), and create value mostly by leveraging their human capital resources (Shrader and Siegel 2007). Several studies (Colombo and Grilli 2005; Shrader and Siegel 2007; Visintin and Pittino 2014) have found that the composition of the founding team is among the key determinants of long-term performance by high-tech entrepreneurial ventures.

The RBV, which links firms' sustainable competitive advantage to organizational resources and capabilities (Barney 1991; Barney et al. 2001; Brush et al. 2001), may be one of the main theoretical frameworks for analyzing USO performance. In 1965, Stinchcombe

and March (1965) highlighted many factors that might influence the development phase of USOs. Among them are the initial conditions of the USO, its founding location, and even the academic groups, entrepreneurial relations, external partnerships, and organizational environment in which it is embedded. Technology-based USOs generally have a heterogeneous founding team to maximize the exploitation of core resources in order to preserve competitive advantage (Hamel and Prahalad 1994).

Mustar (2002) found that USOs are heterogeneous and should be categorized according to their resources (e.g., human capital, including academics, students, and outsiders), institutional support (e.g., the parent university's share of ownership, access to scientific facilities, and public support), and external factors (e.g., product and customer characteristics).

According to the RBV, the most important factor for new business ventures is having access to the right combination of entrepreneurs and managers (Eisenhardt and Schoonhoven 1990; Hambrick and Mason 1984; Heirman and Clarysse 2004; Mustar et al. 2006; Shane and Stuart 2002). According to Finkelstein and Hambrick (1996), this is particularly true for small companies because executive decisions are not hindered by a hierarchical decision-making process. Several authors (Heirman and Clarysse 2004; Druilhe and Garnsey 2004) have identified four main groups of resources in the initial startup phase: social, technological, financial, and human resources. Human resources in the startup phase have been grouped in many ways. A new venture's initial resources are those of its founders (Cooper and Bruno 1977). In this way, the diversity of spin-offs depends on the heterogeneity of their founders (Yusubova et al. 2019). In identifying resources, Grant (1991) defined technical know-how, organizational culture, and tacit knowledge as personnel-based resources. Barney (1991) included training, experience, judgment, intelligence, relationships, and the insights of managers and workers at the firm. In the first formulation of this theory, human resources were viewed as assets controlled by a firm, rather than assets to be exploited and combined to increase their corporate value (Amit and Schoemaker 1993). This vision changed with Teece et al. (1997), who viewed human capital from a systemic and dynamic perspective and explored how firms can combine their resources to achieve competitive advantage.

Because USO founders often lack both the scientific knowledge and business expertise to satisfy the needs of external markets (Franklin et al. 2001; Mosey and Wright 2007), they should appeal to external sources of human capital, such as industrial partners, science parks, and technology transfer advisers (Nicolaou and Birley 2003). Similarly, Mustar (1997) asserted that academics and entrepreneurs need to create a reliable network with other stakeholders, such as other enterprises, public agencies, technological programs, customers, and finance companies. Establishing a USO as a joint venture with another firm can trigger a mechanism, enabling it to overcome the resource constraints typical of venture capital-backed spin-offs (Wright et al. 2004a, b). Lastly, parent organizations can support USOs by transferring their intellectual property (IP) assets (e.g., trademarks, patents, copyrights) and involving academic members in the business venture to transfer their tacit knowledge (Hindle and Yencken 2004).

Some authors have analyzed the characteristics of founders that affect the economic success of a spin-off. According to some studies (Abramo et al. 2012; Rasmussen 2011), the initiation and longevity of a USO are positively influenced when the founders have prolific scientific production coupled with entrepreneurial experience. Similarly, some authors (Bolzani et al. 2014) argue that when founders have an international orientation it helps them exploit IP, thus decreasing USOs' time to market and enhancing the potential for industrial matching. At the early stage, USOs leverage university resources and

decisions made during this time have long-lasting impacts on the performance of future ventures (Rasmussen and Wright 2015).

The ability to combine an innovative technology and a business strategy is the result of interactions among the founders (Chowdhury 2005; Colombo and Grilli 2010; Frohman and Bitondo 1981; Schjoedt and Kraus 2009). The results on the effects of founders' heterogeneity on startup performance are mixed. Some authors (Ensley and Hmieleski 2005) have found that founding team heterogeneity may result in slower growth at USOs than other new ventures.

According to Ensley and Hmieleski (2005), the country of origin is more important for a homogeneous entrepreneurial team, as shown by the founding teams of American USOs, which are more homogeneous in terms of education, industry experience, functional expertise and skills, and they tend to select other founders from their university community (Ensley and Hmieleski 2005). Heirman and Clarysse (2004) found them less successful than more heterogeneous USOs. Similarly, Müller (2006) found that non-USOs were more successful than USOs and that university startups founded by a highly diverse team do not outperform non-USOs in terms of growth. Bonardo et al. (2010) highlighted a negative and significant relationship between market performance and the presence of academics on management teams after the initial public offering. This is related to the divergent goals between non-academic and academic founders, who are more interested in furthering research objectives (Visintin and Pittino 2014). Thus, when academic entrepreneurs involve surrogate entrepreneurs, i.e., non-academics with managerial experience (Lockett et al. 2003; Vohora et al. 2004), they might improve USO performance (Lundqvist 2014). At the same time, USOs in education, industry experience, and management expertise tends to have more homogeneous human capital than their corporate counterparts, as they attract top managers from the university community (Ensley and Hmieleski 2005). However, USOs can acquire external capabilities to coach academic members, develop commercial skills, and increase credibility with potential investors (Lockett et al. 2003; Vanaelst et al. 2006; Vohora et al. 2004).

It follows that both the ratio of non-academics to academics and academic members' homogeneity should be further investigated. The full-time commitment of non-academic personnel, compared to the part-time availability of academic members, can result in internal conflicts (Jehn 1995) that lead to mistrust among members and undermine the entrepreneurial team (Pelled et al. 1999). Finding a demographically balanced founding team requires greater exploitation of members' capabilities regarding scientific and business issues. The team size can affect the balance between these two groups (Amazon and Sapienza 1997). In particular, the founders of small firms can easily share their knowledge and mutually supervise tasks. As founding teams increase in size, the potential for conflicts and diverging expectations rises, threatening USO survival (Backes-Gellner et al. 2006; Smith et al. 1994). Sometimes, academic founders preserve the composition of the existing research team, enhancing USO members' integration and communication capabilities (Parson et al. 1992; Williams and O'Reilly 1998). Therefore, a homogeneous academic subgroup on founding teams can enhance members' integration, enhance entrepreneurial learning, and engender better performance (Clarysse and Moray 2004; Knockaert et al. 2011). In southern Italy, some empirical evidence shows that university policies and founder characteristics play an important role in starting a spin-off. Moreover, the support of the university's TTO is considered an essential factor in the success of Italian spin-off ventures, even if founders' academic careers are not helped by their involvement in them (Parmentola and Ferretti 2018).

2.2 Governance and gender issues

Corporate governance has not been considered a relevant factor in USO survival and growth, as ownership and control typically overlap in USOs, which reduces agency problems. Additionally, corporate governance has not been considered important because these ventures have no financial market exposure (Di Berardino 2016). However, recent studies recognize the importance of governance issues in USOs (Palumbo 2010; Colombo et al. 2014; Prencipe 2016) as these venture investments are often characterized by rapid growth and consider real investment opportunities due to their technology-driven nature and the industry expertise of their founders. These features may lead to high information asymmetry between management and owners (Gaver and Gaver 1995). Therefore, internal governance mechanisms related to the evolution and composition of USOs' board of directors (BoD), could be considered potential factors in creating value and innovation (Bjørnåli and Gulbrandsen 2010). USOs typically have a high degree of ownership concentration, CEO duality, and overlap between managers and founders (Di Berardino 2016). These characteristics reduce agency problems and allow extensive expertise to shape efficient and flexible decision-making (Di Berardino 2016).

In this regard, literature on CEO duality and firm performance is inconsistent. The overlap in CEO and chairman positions at USOs implies a less independent BoD, as well as lower efficiency in supervising managers' activities. Accordingly, the results of firm performance are scant. Furthermore, stewardship theorists state that splitting up CEO duality can improve decision-making (Finkelstein and D'Aveni 1994).

In the context of Italian small and medium-size enterprises (SMEs), Italian USOs typically have chairpeople who are simultaneously the CEO, which agency cost theorists find objectionable (Pugliese and Wenstøp 2007). Having independent directors at SMEs may lead to fairer decision-making between the CEO and the chairperson, enhancing firm performance (Rashid and Lodh 2011). In the presence of resource constraints, Boyd (1995) highlighted that CEO duality creates leverage to involve external stakeholders, such as investors or outside managers, and to increase the presence of women on the BoD in order to improve stakeholder relations, decision-making, and integration among entrepreneurial members (Hillman et al. 2000).

Researchers have analyzed the relationship between women on BoDs and firm performance (Burke 2000). The presence of women on the BoD is linked to better financial performance in several studies, such as Shrader et al. (1997), who examined 200 Fortune 500 firms, and Carter et al. (2003), who looked at 797 Fortune 1000 firms. At the same time, other scholars (Rose 2007) failed to find a link between gender diversity among the BoDs and higher firm performance.

Scholars have also evaluated gender diversity at USOs. Stephan and El-Ganainy (2007) found that academic entrepreneurship is gendered, in which women hold fewer critical university positions where novel ideas are explored, leading to a gender gap in academic businesses (Delmar and Davidsson 2000; Langowitz et al. 2005; Reynolds et al. 2001).

Gender diversity on the BoD can have positive and negative effects. According to some scholars, gender diversity helps decision makers exploit undervalued talent pools, improve problem solving, achieve innovative organizational models (Cox 2001), and drive senior managers to understand the value of inclusive decision-making (Wei and Wu 2013). Gender-diverse BoDs can stimulate new ideas at the firm (Richard et al. 2013). However, studies have mixed results on the relationship between gender diversity and firm value, finding positive, negative, or no relationships between them (Bøhren

and Strøm 2010). By adding women to BoDs, firms benefit from a wider pool of human capital (Runyan et al. 2006). Female managers tend to have higher university education, surpassing men in marketing and sales competence (Groysberg and Bell 2013), and heterogeneous boards can embrace market opportunities with smarter solutions (Carter et al. 2010). According to Ali et al. (2014), increasing gender diversity on BoDs has the potential to introduce new perspectives into decision-making, improving its effectiveness at the cost of becoming more time-consuming (Lau and Murnighan 1998; Campbell and Mínguez-Vera 2008).

The university context is ambiguous on the matter of support for women (Dahlstrand and Politis 2013). On the one hand, women are generally underrepresented in senior posts (Thursby and Thursby 2005; Rosa and Dawson 2006); on the other hand, universities also offer great opportunities for education and learning that can empower women to start and develop businesses (Wilson et al. 2007). Thus, the university environment offers interesting scenarios related to women's academic entrepreneurship that merit further study.

Despite growing scholarly interest in academic entrepreneurship, research on women's participation in creating and developing USOs has attracted little attention. Only Rosa and Dawson (2006) have examined female academic entrepreneurship, finding female entrepreneurs at only 12% of university startups in England. Additionally, McAdam and Marlow (2010) observed that in Ireland, just one female entrepreneur was brought to market through an incubator sponsored by a university.

3 Research hypotheses

The RBV model (Barney 1991) suggests that the composition of the founding team is the main factor affecting the growth and success of USOs (Heirman and Clarysse 2004; Mustar et al. 2006; Hambrick and Mason 1984; Eisenhardt and Schoonhoven 1990; Shane and Stuart 2002). As the optimal combination of entrepreneurs and managers is pivotal for a USO to create value, we analyzed how the involvement of external entities (e.g., for profit/nonprofit) and academics (as both members and shareholders) affects USO economic success.

Researchers have demonstrated that the integration of academic and non-academic profiles plays an important role in USO survival and growth (Visintin and Pittino 2014; Rasmussen et al. 2011). For example, Tekleab et al. (2016) demonstrated that high functional diversity can improve USO performance. Visintin and Pittino (2014) highlighted that the integration of academic and non-academic members enhances the sales and employment growth of USOs. However, previous studies compared only the percentage of members in each group when analyzing profile differentiation Minichilli et al. 2010; Visintin and Pittino 2014) and did not consider their respective share-based payments. As such, scholars have not evaluated the proportion of non-academic and academic ownership. Hence, we propose the following research hypotheses:

Hypothesis 1a The proportion of USO ownership by non-academic versus academic members affects its economic performance.

Hypothesis 1b The proportion of non-academic versus academic USO founders affects its economic performance.

In addition, a deeper understanding of the integration of different skills and backgrounds can be useful, specifically regarding the ability to involve external industrial partners (Mustar et al. 2006). Accordingly, we analyzed how corporate ventures build business experience. Because USO founders often lack a suitable combination of skills—that is, both academic knowledge and business expertise (Franklin et al. 2001; Mosey and Wright 2007)—they often appeal to additional sources of human capital (Nicolaou and Birley 2003). We predict that the joint presence of a parent organization and external entities may enhance the integration of scientific and business skills, with a positive impact on USO performance (Visintin and Pittino 2014). Thus, we propose the following hypothesis:

Hypothesis 1c Well-balanced ownership between the university and external entities affects a USO's economic success.

According to the prior literature, academic members tend to adopt the behavioral norms of their research team, fostering members' integration and communication as well as the career path of some academics (Beckman 2006; Gurdon and Samson 2010; Parson et al. 1992; Williams and O'Reilly 1998). We explore ownership issues by evaluating the extent to which heterogeneity in academic status plays a critical role in USO success. A heterogeneous academic subgroup in founding teams can enhance members' integration and engender better performance because hierarchical diversity can preserve tacit skills and group routines, which might foster economic success (Clarysse and Moray 2004; Knockaert et al. 2011).

We therefore analyzed the impact of heterogeneity of academic members on USO economic success and propose the following research hypothesis:

Hypothesis 2 A heterogeneous subgroup of academic shareholders affects USO economic performance.

Governance studies on USOs are still rare (Prencipe 2016). Because USOs are mostly SMEs, we analyze the link between USO performance and board composition, focusing on CEO duality and the participation of women.

Scholars still have not reached a clear consensus on the impact of CEO duality on corporate performance at SMEs. According to agency theory (Pugliese and Wenstøp 2007), even in the context of small firms, the chairperson and chief executive officer should not be the same person, as such overlap may lead to an imbalance of power, thereby diminishing USO performance (Gabrielsson et al. 2014; Rashid and Lodh 2011), while adopting the stewardship theory (Finkelstein and D'Aveni 1994) the CEO duality may help in getting a more effective decision making processes as it helps in creating a clear hierarchy in the firm. Considering the limited empirical findings and ambiguous theoretical predictions, we propose the following hypothesis:

Hypothesis 3 CEO duality can influence USO economic performance.

The university environment still appears weak in fostering female participation in new business ventures, though management studies have paid increasing attention to women's self-efficacy in business ventures (Wilson et al. 2007). Hence, despite the growing interest in academic entrepreneurship generally, few studies have examined women's engagement in academic entrepreneurship. Only Rosa and Dawson (2006) have studied female

academic entrepreneurship, finding that only 12% of university startups in England were initiated by women. McAdam and Marlow (2010) observed that in Ireland just one venture headed by a female entrepreneur was brought to market through an incubator sponsored by a university. Therefore, we evaluate the impact of female board members on USO economic performance from a human capital perspective. Given the lack of reliable evidence, we test the following hypothesis:

Hypothesis 4 Gender diversity on the BoD affects USO economic performance.

Our hypotheses regarding the four research topics discussed are summarized in Table 1.

4 Empirical study

4.1 Sample and data

As suggested in Parmentola and Ferretti (2018), we consider a broad set of USOs in southern Italy to examine common effects, focusing on southern Italy as it has been analyzed in few other studies (Parmentola and Ferretti 2018; Algieri et al. 2013; Abramo et al. 2012). We used data from the Netval directory to identify the entire population of active USOs in southern Italy. Several national and international studies have also used the Netval database, which is constantly updated by the TTOs at Italian universities (Algieri et al. 2013; Muscio et al. 2016; Ramaciotti and Rizzo 2015). We focused on the following regions in southern Italy: Abruzzo, Basilicata, Calabria, Campania, Molise, and Puglia. Then, we selected both pure and hybrid spin-offs that had at least one academic member on the founding team and were started at a university. We excluded spin-offs proposed by public research centers that collaborate with universities. Our goal is a better understanding of the key factors that foster USO economic growth, given that, in this part of Italy, it has been more difficult for IP to become a successful asset (Algieri et al. 2013). We identified the academic position of spin-off founding team members using the CINECA scientific platform, a nonprofit consortium that includes 70 Italian universities. To do so for academic members who are not listed in the CINECA platform, such as PhD students and research fellows, we checked the website of the university where they work.

We chose this sample to measure the number and share of academic members on the entrepreneurial team. The equity share of the parent organization, as well as external partners that contributed to the research, is also included in the ownership analysis.

Applying these conditions to our sample selection, we calculated a spin-off population of 136 firms established from 1996 to 2016. Because our research goal is to investigate the impact of certain entrepreneurial and managerial factors on USO economic performance, we collected data on the ownership, governance, and financial health of each spin-off from AIDA-Bureau Van Dijk, a database of financial and accounting data on Italian companies.

4.2 Variables

To ensure comparability with previous studies, we used proxy measures consistent with previous research and employed dichotomous and ratio measures for the dependent and independent variables. In selecting variables, we adopted the following approach. On the one hand, we considered variables that are endogenous to the functioning of a spin-off,

Table 1 Research topics and research gaps

Research topics	Composition of USO founding team	Founders' academic diversity	Corporate governance models at USOs	Gender diversity of USOs
Research gaps	Composition of non-academic and academic shareholders and USO success	Academic positions on founding team and USO success	Overlap between chairman and chief executive officer at USO; CEO duality and USO success	Female participation in management decision-making and USO success

focusing on the parent's share and team size (see Table 2). On the other hand, we applied economic controls that are standard in the previous literature (spin-off's total assets, university share, number of shareholders, and spin-off age).

4.2.1 Dependent variables

We measured USO economic success using three different perspectives, as highlighted in the literature review: (1) a market-based measure (Westerberg and Wincent 2008) using sales growth, expressed in terms of the natural logarithm of a 1-year variation rate (Weinzimmer et al. 1998; Schmelter 2004; Egelin et al. 2003; Lendner 2003; Steinkühler 1994; Roberts 1991; Hunsdiek 1987; Kulicke and Krupp 1987); (2) an accounting-based measure of the profitability rate of spin-offs in general, expressed by the ratio of return on assets (ROA) of USOs (Woo et al. 1992; Egelin et al. 2003; Steinkühler 1994; Roberts 1991); and (3) an organization-based measure, expressed as the rate of employment growth (Schmelter 2004; Egelin et al. 2003; Steinkühler 1994; Kulicke and Krupp 1987), which is obtained by calculating the difference between the prior 2 years of a USO's activity (Delmar et al. 2003; Zhang 2009; Visintin and Pittino 2014). As shown in the correlation matrix in Table 3, these three variables are weakly related, allowing us to independently analyze these perspectives. These approaches for quantifying USO economic performance take into account how management handles various corporate functions and provide an overall measurement of company performance.

4.2.2 Independent variables

Academic entrepreneurship In assessing the academic presence and influence on USO founding teams, we measured the balance between research and business membership in three ways. The first variable represents the relationship between academic and non-academic subgroups by calculating the ratio between them (Visintin and Pittino 2014). The second measures the share held by each member to clarify whether academics dominate USO ownership. Previous studies adopted a similar approach by dividing an executive team into two categories based on a single attribute (Minichilli et al. 2010). Finally, the third assesses the equity retained by external entities, such as firms and the university.

Diversity of academic ownership We estimated the heterogeneity of academic founders using a diversity index that is typical in management studies: the Blau index (Blau 1977). We included academic positions ranging from PhD students to professors. The higher the Blau index is, the more heterogeneous the academic founders are (Visintin and Pittino 2014).

CEO duality We identified all USOs in southern Italy at which the CEO position is simultaneously held by the chairperson, regardless of whether that person is in the academic or non-academic subgroup. We indicated them using a dummy variable (Prencipe 2016).

Participation of women on the BoD We identified USOs with women on the BoD using a dummy variable for USOs with female directors.

4.2.3 Control variables

To improve the reliability of our analysis, we adopted control variables (see Table 2) to account for variance. We selected variables that could reasonably influence variability in

Table 2 Definition of the variables

Variables	Description	Measurement
Performance variables		
<i>ROA</i>	EBIT/assets, representing economic performance	Ratio
<i>Ln Δ SALES</i>	Logarithm of the 1-year change in Sales (expressed in Euros)	Logarithm
<i>Δ EMP</i>	One-year change in the number of USO employees	Value
Founding team variables		
<i>A_INDEX_m (Hp1_a)</i>	Relationship between non-academic and academic members of founding team	Ratio
<i>A_INDEX_s (Hp1_b)</i>	Share-based relationship between non-academic and academic founders	Ratio
<i>FI (Hp1_c)</i>	Share-based relationship between firms and a university	Ratio
<i>BLAU (Hp2)</i>	Blau Index [p_i : e.g., Ph.D. student category (k)] to represent diversity among academic founders	$1 - \sum_{i=1}^k p_i^2$
Governance variables		
<i>CEO DUA (Hp3)</i>	The practice of a single individual serving as both CEO and board chair, duality = 1; otherwise, duality = 0	0,1
<i>W_BOD (Hp4)</i>	Presence of female managers on the BoD	0,1
Control variables		
<i>TA</i>	Total amount of assets owned by the USO	Logarithm
<i>PS</i>	Share of university involvement in a USO's founding team	%
<i>TS</i>	Number of shareholders	No
<i>AGE</i>	USO age since its establishment	No. of years

Table 3 Correlation matrix

Variables	A_INDEX_s	A_INDEX_m	FI	BLAU	CEO_DUA	W_BOD	TA	PS	TS	AGE	VIF
A_INDEX_s	1										1.32
A_INDEX_m	0.413***	1									1.67
FI	-0.112	-0.239**	1								1.17
BLAU	-0.071	-0.393**	-0.022	1							1.73
CEO_DUA	0.208*	0.084	0.034	0.029	1						1.29
W_BOD	-0.035	0.065	-0.160	0.021	-0.059	1					1.09
TA	0.181*	0.024	0.144	0.058	0.193*	-0.173*	1				1.16
PS	-0.017	0.039	-0.161	-0.102	-0.386***	0.160	-0.059	1			1.34
TS	0.211*	0.141	-0.191*	0.010	-0.013	0.038	0.139	0.165	1		1.62
AGE	0.051	0.016	-0.087	0.101	-0.013	-0.004	0.141	0.056	0.227*	1	1.08

For definitions of the variables, see Table 2. * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$

the dependent variables of the model. Therefore, we chose four control variables: *Total Asset*, *Parent share*, *Team Size*, *Spin-off age*.

The first one is used to factor in the assets of the company, while the second one measures the involvement of a university in a USO in terms of risks assumed and direct investment in the activities of the spin-off. The last two variables, *Team size* and *Spin-off age* measure, respectively, the number of shareholders and the spin-off longevity.

4.3 Analysis and discussion of the results

We analyzed our dataset with a cross-sectional approach using an ordinary least squares (OLS) regression analysis. To test the impact of the independent variables on USO economic performance, we developed three separate models, one for each dependent measure, each of which included control factors, as shown in Table 2. Model 1 estimates whether the four research hypotheses hold for ROA performance, Model 2 for sales growth, and Model 3 for employment growth. For each dependent variable, we carried out a stepwise procedure with backward elimination (Henderson and Denison 1989; Myers 1990) to identify the best model. Following our analysis of USOs, we discuss our results for each measure separately, whose statistics are described in Table 4.

Looking at the effect of the variables on profitability in Model 1 (Table 5), we found that the involvement of external entities in USO ownership decreases corporate profitability growth (FI: -30.717 ; $p < 0.05$), in contrast to the literature (Visintin and Pittino 2014; Gübeli and Doloreux 2005; Nicolaou and Birley 2003) on surrogate entrepreneurs that improve USO economic performance. This finding highlights the need to increase USO independence from external entities, which is confirmed by the significant and negative relationship between the parent share and asset productivity (PS: -103.516 ; $p > 0.05$). These results suggest that reducing the embeddedness of the USO in the university can

Table 4 Descriptive statistics

Variables	No. of Obs	Mean	SD
Performance variables			
<i>ROA</i>	135	2.03	19.42
<i>Ln Δ SALES</i>	119	0.01	1.01
<i>Δ EMP</i>	136	0.34	2.13
Founding team variables			
<i>A_INDEX_m</i>	136	1.02	1.10
<i>A_INDEX_s</i>	136	1.22	2.94
<i>FI</i>	136	0.06	0.13
<i>BLAU</i>	136	0.36	0.27
Governance variables			
<i>CEO DUA</i>	136	0.30	0.46
<i>W_BOD</i>	136	0.17	0.38
Control variables			
<i>TA (ln)</i>	136	4.99	0.62
<i>PS</i>	136	0.02	0.04
<i>TS</i>	136	5.54	3.53
<i>AGE</i>	136	7.69	4.09

Table 5 OLS Regression model (backward stepwise approach), with dependent variable: ROA

Variables	MODEL A ¹ Dependent variable ROA	MODEL B ² Dependent variable ROA	MODEL C ³ Dependent variable ROA
Founding team variables			
<i>A_INDEX_s (Hp_{1a})</i>	-0.304	-	-
<i>A_INDEX_m (Hp_{1b})</i>	-0.172	-	-
<i>FI (Hp_{1c})</i>	-32.412**	-30.717**	-26.289**
<i>BLAU (Hp₂)</i>	2.848	-	-
Governance variables			
<i>CEO DUA (Hp₃)</i>	-3.513	-4.038	-
<i>W_BOD (Hp₄)</i>	-7.728	-7.580	-
Control variables			
<i>TA</i>	5.348*	5.076*	4.809*
<i>PS</i>	-98.558**	-103.516**	-96.195**
<i>TS</i>	-0.134	-	-
<i>AGE</i>	-0.462	-0.460	-
<i>R²</i>	0.129	0.124	0.087
<i>R²_Adj</i>	0.057	0.082	0.066
<i>Model F</i>	1.791*	2.955***	4.074***

For descriptions of the variables, see Table 1. * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$

¹Model A is the full model

²Model B is the final model

³Model C is the model with only significant variables

improve freedom of action for the founding team and, in consequence, allow the team to find the best combination of resources to exploit and improve the innovation potential of the spin-off (Zahra et al 2007).

At the same time, our results highlight that spin-offs with a greater asset endowment are usually better able to increase their profitability (ROA). This finding is unexpected, as it should be negatively related to total assets (TA: 5.076; $p < 0.1$).

Regarding sales (Table 6), examined in Model 2, shareholding of USOs by an external entity has a positive effect on their market potential (FI: 0.603; $p < 0.01$). This result is consistent with the RBV. A tight link with other players in the market can help the spin-off gain access to external resources (Chowdhury 2005; Beckman et al. 2007; Ensley and Hmieleski 2005; Eisenhardt and Schoonhoven 1990; Zimmerman 2008; Visintin and Pitino 2014). Moreover, we found that academic status diversity has a positive impact on USO sales growth (BLAU: 0.151; $p < 0.1$), supporting the assumption that hierarchical diversity on an academic founding team can preserve tacit skills and group routines that contribute to economic growth (Clarysse and Moray 2004; Knockaert et al. 2011). The literature review highlighted the need for various skills in spin-off operations and how CEO duality can support this knowledge transfer (Boyd 1995) and, at the same time, reduce conflicts between academic and non-academic managers (Jehn 1995; Pelled et al. 1999). These concerns are confirmed by our empirical findings, as CEO duality is positively associated with sales growth (CEO DUA: 0.218; $p < 0.01$). Therefore, we reject the agency theory perspective (Pugliese and Wenstøp 2007; Gabrielsson et al. 2014; Rashid and Lodh 2011),

Table 6 OLS regression model (backward stepwise approach), with dependent variable: Ln Δ SALES

Variables	MODEL A ¹ Dependent variable Ln Δ SALES	MODEL B ² Dependent variable Ln Δ SALES	MODEL C ³ Dependent variable Ln Δ SALES
Founding team variables			
<i>A_INDEX_s</i> (<i>Hp_{1a}</i>)	-0.011	–	–
<i>A_INDEX_m</i> (<i>Hp_{1b}</i>)	-0.024	–	–
<i>FI</i> (<i>Hp_{1c}</i>)	0.576***	0.603***	0.621***
<i>BLAU</i> (<i>Hp₂</i>)	0.126	0.151*	–
Governance variables			
<i>CEO DUA</i> (<i>Hp₃</i>)	0.200**	0.218***	0.212**
<i>W_BOD</i> (<i>Hp₄</i>)	-0.051	–	–
Control variables			
<i>TA</i>	-0.255***	-0.247***	-0.255***
<i>PS</i>	-0.058	–	–
<i>TS</i>	-0.202*	-0.233**	-0.191**
<i>AGE</i>	-0.101	-0.102	–
<i>R²</i>	0.360	0.354	0.328
<i>R²_Adj</i>	0.296	0.316	0.302
<i>Model F</i>	5.574***	9.411***	12.82***

For definitions of the variables, see Table 1. * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$

¹Model A is the full model

²Model B is the final model

³Model C is limited to only significant variables

according to which the same person should not occupy a position as both chairperson and chief executive officer.

The results for Model 3 (Table 7), on employment growth (Δ EMP), are very similar to those of Model 2, indicating that shareholdings by an external entity (*FI*: 4.436; $p < 0.05$) and CEO duality (*CEO DUA*: 0.999; $p < 0.01$) has a positive effect on employment growth. Our results show that academic members (*A_INDEX_m*: -0.261; $p < 0.05$) have a negative effect on employment growth. This finding is consistent with the RBV (Barney 1991), as having more business partners helps spin-offs become more effective in hiring human capital (Gübeli and Doloreux 2005).

5 Limitations and further research

Our study has some limitations regarding the participation of women on BoDs because we did not analyze women's managerial tasks in corporate decision-making. However, the low number of women observed (24) prevented us from identifying women's impact on USO performance. An extension of our study to the entire country might provide more reliable empirical evidence.

Additionally, we evaluate the academic diversity of academic founders, regardless of whether they are shareholders. This might be relevant for assessing the relationship between academic shareholding and USO strategic decisions. We did not consider the

Table 7 OLS regression model (backward stepwise approach), with dependent variable: Δ EMP

Variables	MODEL A ¹ Dependent variable Δ EMP	MODEL B ² Dependent variable Δ EMP	MODEL C ³ Dependent variable Δ EMP
Founding team variables			
<i>A_INDEX_s</i> (<i>Hp_{1a}</i>)	0.008	–	–
<i>A_INDEX_m</i> (<i>Hp_{1b}</i>)	–0.401*	–0.389**	–0.261**
<i>FI</i> (<i>Hp_{1c}</i>)	4.333***	4.263***	4.436***
<i>BLAU</i> (<i>Hp₂</i>)	–0.916	–	–
Governance variables			
<i>CEO DUA</i> (<i>Hp₃</i>)	1.138***	1.170***	0.999***
<i>W_BOD</i> (<i>Hp₄</i>)	0.379	–	–
Control variables			
<i>TA</i>	0.099	–	–
<i>PS</i>	3.651	–0.897	–
<i>TS</i>	–0.009	–	–
<i>AGE</i>	0.014	–	–
<i>R²</i>	0.191	0.185	0.186
<i>R²_Adj</i>	0.124	0.153	0.165
<i>Model F</i>	2.873***	5.773***	8.449***

For definitions of the variables, see Table 1. * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$

¹Model A is the full model

²Model B is the final model

³Model C is limited to only significant variables

cultural background of academic members, which might shed light on why they tended to hold managerial positions.

Given these limitations, and consistent with our empirical study, we suggest two topics for future research: (1) an analysis of the academic founders' tendency to be shareholders and its impact on economic performance and innovation readiness; and (2) an exploration of how the USO research team members are hierarchically bound to academic careers, or are willing to exploit their knowledge and capabilities in a business context.

6 Conclusions

This research is part of the research field on academic business ventures, taking a resource-based perspective to analyze the entrepreneurial and governance factors that characterize the organization of USOs (Barney 1991). This paper focuses on academic members and their share of the founding team, academic diversity in ownership, and the involvement of external organizations in entrepreneurial ventures. Moreover, we tested the impact of CEO duality on USO performance and whether the participation of women in management decision-making affects USO economic performance.

We conducted a systematic analysis of the USOs in southern Italy. The only prior research paper on this topic that examined southern Italy offered a multiple case study of

19 USOs over a 12-month period and employed a different theoretical framework (Parnentola and Ferretti 2018).

Our focus on the human capital at USOs frames academic knowledge as a reliable asset in a resource-constrained environment, such as southern Italy. We identified the factors that encourage universities to transfer knowledge and thus promote economic growth and good practices. We also analyzed the equity involvement of USO parent organizations for two reasons: first, to explore whether the involvement of a public entity (in this case, a university) affects academic entrepreneurship; second, to evaluate whether the parent share implies greater resource availability, which in turn leads to better USO performance.

Based on our findings, we argue that USOs with high involvement by external entities have better market sales and employment (Tables 6, 7) than those with fewer outside equity partners. From an RBV perspective (Barney 1991), USOs have a better combination of human resources between the university and industry and take advantage of a higher employment rate. Moreover, after an external partner joins a USO founding team, the venture can leverage the partner organization for additional human capital, including market knowledge, skills, and expertise. This result is consistent with prior RBV studies that emphasized the importance of founding teams with a heterogeneous composition (Chowdhury 2005; Beckman et al. 2007; Ensley and Hmieleski 2005; Eisenhardt and Schoonhoven 1990; Zimmerman 2008; Visintin and Pittino 2014). The right combination of academic and non-academic members can be a main success factor in terms of economic performance (Eisenhardt and Schoonhoven 1990; Hambrick and Mason 1984; Heirman and Clarysse 2004; Mustar et al. 2006; Shane and Stuart 2002), given that USOs are typically small companies at which executive decisions are not hindered by highly hierarchical decision-making processes (Finkelstein and Hambrick 1996).

In addition to benefiting from a higher number of employees, high non-academic involvement implies shared asset management, which in turn increases the total available assets for the USO. As shown in Table 5, this improves the ROA of USOs. At the same time, the strong presence of external owners will limit the parents ownership; as a result, its negative effect on USO profitability could be addressed to the increasing shared assets (Table 5).

With regard to the governance models at USOs, our findings suggest that CEO duality has a significant and positive impact on economic performance in terms of sales and employment (Tables 6, 7), which is consistent with the views of stewardship theorists who support CEO duality to enhance the decision-making efficiency of USOs (Finkelstein and D'Aveni 1994). Our results indicate that CEO duality raises USO performance. Therefore, we reject the agency theory perspective (Pugliese and Wenstøp 2007; Gabrielsson et al. 2014; Rashid and Lodh 2011), according to which, even in the SME context, CEO duality leads to an imbalance of power, thus weakening USO performance.

Concerning USO gender diversity, we acknowledge that a more detailed analysis is necessary. Our results show divergent and insignificant empirical evidence in all our analytical models (Tables 5, 6, 7); therefore, to explore how board selection is affected by gender issues and how this influences managerial decision-making in university business ventures, we need to focus on the role of women on the BoD at USOs.

Regarding academic shareholders, at some levels, we show that USOs in southern Italy with heterogeneous academic founders (high Blau Index) perform better in terms of sales revenue than USOs with a less diverse group of academics (Table 6). In other words, USOs founded by an academic group with a few or only one academic (e.g., a founding subgroup consisting of research fellows) underperforms USOs with more academic members, such as Ph.D. students, assistant professors, and full professors, in terms of market sales. This

bolsters the assumption that hierarchical diversity preserves tacit skills and group routines that contribute to economic growth by USOs (Clarysse and Moray 2004; Knockaert et al. 2011). In this way, a new business venture retains the organizational and relational routines of its academic founding team. However, the absence of hierarchical diversity on an academic founding team might result in a loss of tacit skills and coordination capabilities that contribute to the economic growth of the startup.

Our research study might support local public actors—from a human capital perspective—in identifying the factors that encourage university TTOs to link academic IP to local innovation systems. Therefore, policymakers could regard universities as one of the main stakeholders in achieving local economic development.

Our findings have several practical implications. First, the TTOs at academic institutions would benefit by adopting our view that in southern Italy having an external shareholder has a positive effect on USOs' economic health, supports firm success, and has positive externalities for society. This could be framed as a best practice for universities in fostering local economic development. Quality partner selection can accelerate USOs' time to market, resulting in economic growth at USOs within a short timeframe. Additionally, after TTOs support a well-functioning academic founding team, external entities can benefit from this human capital, thus enhancing their R&D activities. Finally, in academic technology transfer aimed at creating new entities from research, knowledge transfer managers should evaluate academic competences and capabilities in terms of scalability, thereby promoting a well balanced governance model between academic and non-academic members, as supported by the literature.

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