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ACADEMIC ENTREPRENEURSHIP: A MULTILEVEL EXAMINATION OF INDIVIDUAL, SUBUNIT AND ORGANIZATION EFFECTS

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Abstract

This study utilizes a multilevel approach to both estimate the relative importance of individual, subunit, and organization effects on entrepreneurial intentions in academia, as well as to investigate specific factors within the subunit effect and their interactions with other levels. Using a dataset of 2,652 researchers from 386 departments in 24 European universities, our findings reveal that intra-university differences, caused by the influence of the department, should not be ignored when studying academic entrepreneurship. Whereas researchers' entrepreneurial intentions are mostly influenced by individual differences, department membership explains more variation than the university as a whole. Furthermore, drawing upon organizational culture literature, we identify a department's adhocracy culture, characterized by flexibility and an external orientation, to be positively related to entrepreneurial intentions. Finally, consistent with trait activation theory, we find that strong adhocracy cultures reinforce the positive association between proactive personality and entrepreneurial intentions. This effect is further intensified when the university also has a technology transfer office with a substantial size. Our results have relevant implications for both academics and practitioners, including university managers, department heads and policy makers.

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ABSTRACT

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INTRODUCTION

Entrepreneurship research is dominated by single-level studies, mainly focusing on the individual or the firm as unit of analysis (Davidsson & Wiklund, 2001). Recently, however, a growing recognition has emerged that a multilevel approach, incorporating individual, organizational and environmental elements, yields a more complete understanding of entrepreneurial phenomena (Hitt et al., 2007; Welter, 2011). Whereas numerous opportunities still exist for multilevel research to make a significant contribution to the field of entrepreneurship, so far, studies building bridges across different levels remain scarce.

The need to go beyond a single level of analysis is particularly relevant in the academic entrepreneurship literature. Following the growing role of universities as a hub of innovation, commercialization and new firm creation, alongside traditional tasks of research and teaching (Ambos et al., 2008), scholars have devoted substantial attention to explaining academic entrepreneurship. However, while distinct levels of analysis have been considered in the academic entrepreneurship literature, these have generally been studied in relative isolation (Lockett et al., 2005; Rothaermel et al., 2007). In particular, an extensive body of literature at the micro-level has scrutinized the characteristics of individual academic entrepreneurs, founding teams and spin-off firms. Meso-level studies have focused on the university and the technology transfer office (TTO), in order to identify the policies, mechanisms and incentives that foster academic entrepreneurship. Finally, some research at the macro-level has explored the influence of governmental regulations or initiatives, and industry or market conditions (Djokovic & Souitaris, 2008). Consequently, to date, insights are lacking on how the heterogeneous nature of context (i.e. meso and macro-level) affects the emergence and performance of (potential) academic entrepreneurs (i.e. micro-level). Given that organizational contexts can shape the development of individual cognitions, attitudes and behaviors (Mowday & Sutton, 1993), referred to as "top-down" processes in multilevel theory (Kozlowski & Klein, 2000), our study

aims at bridging the gap between the micro- and meso-level. Specifically, we acknowledge that researchers' intentions to engage in academic entrepreneurship may emerge due to variation at the meso-level, next to, and through interaction with, individual-related antecedents.

In addition, current meso-level studies have predominantly examined the role of the university. While university characteristics, such as support structures and infrastructure (e.g., Phan et al., 2005), research intensity (e.g., Hewitt-Dundas, 2012), and the nature of the TTO (e.g., Bercovitz et al., 2001), are important drivers of academic entrepreneurship, departments within the same university may demonstrate great heterogeneity in terms of entrepreneurial activity (Grimaldi et al., 2011). So far, however, empirical studies have largely ignored the department level, which is quite surprising. Indeed, some research has indicated the importance of the "localized social environment", with special attention allocated to workplace peers (Kenney & Goe, 2004; Louis et al., 1989; Stuart & Ding, 2006) and the department chair (Bercovitz & Feldman, 2008). Furthermore, Rasmussen et al. (2014) revealed significant differences in early spin-off performance due to variation in initial departmental support. Nevertheless, while of considerable theoretical and practical interest, empirical evidence on the department level is scant. Since researchers are typically embedded in departments, which are in turn embedded in universities, one of the fundamental questions left unanswered is the importance of the relatively neglected department level to variance in academic entrepreneurship, compared with the well-studied individual and university level.

Accordingly, the first research objective of this paper is to advance our understanding whether the department actually matters, through evaluating the extent to which department membership explains differences in academic entrepreneurship. Specifically, we study academic entrepreneurial intentions, which have recently received increased attention in the literature (e.g., Obschonka et al., 2012). Using data on 2,652 researchers nested in 386 departments at 24 European universities, we utilize hierarchical linear modeling (HLM) to simultaneously assess the variance accounted for by the individual, subunit and organization level. Subsequently, as second research objective, our paper disentangles the direct effect of specific factors at the department level on entrepreneurial intentions, as well as cross-level interactions between the micro-level (researcher) and the meso-level (university and department). Specifically, building on organizational culture literature and trait activation theory (Tett & Burnett, 2003), we develop and test hypotheses about the role of department culture.

This work contributes to the (academic) entrepreneurship literature in several ways. First, responding to general calls for multilevel research in entrepreneurship (Shepherd, 2011; Zahra & Wright, 2011), our study provides more fine-grained insights into relationships that traverse different levels of analysis. In particular, we address the need to contextualize entrepreneurship in academia, put forward as pertinent future research avenue by Djokovic & Souitaris (2008), Lockett et al. (2005), Markman et al. (2008), and Rothaermel et al. (2007). The present study further adds to the extant academic entrepreneurship literature that generally has concentrated on either the micro- or meso-level of analysis, but has lacked sufficiently complex models or richness in data for blending the two. Second, by examining the extent to which the department is influential, we contribute to the emerging debate in the academic entrepreneurship literature on whether a shift in focus is needed from the university level to the relatively neglected department level (Rasmussen et al., 2014). Additionally, we enrich the entrepreneurship literature by introducing and highlighting the importance of organizational subcultures to the (academic) entrepreneurial process, thereby integrating insights from person-situation interaction theory. Finally, we extend the recent stream of studies on entrepreneurial intentions in academia by

investigating the interplay between individual and contextual determinants in the configuration of such intentions.

THEORY AND HYPOTHESES

Research objective 1: Department level effects on entrepreneurial intentions

Organizations are generally characterized by differentiation (horizontal) and integration (vertical), resulting in multiple levels of conceptual interest (Kozlowski & Klein, 2000). Lower-level entities are nested hierarchically in upper-level entities, such as individuals in subunits, and subunits in organizations (Hitt et al., 2007). Organizational behavior researchers have demonstrated the pivotal role of the subunit level for a broad range of individual outcomes including innovation (Miron et al., 2004), creativity (Hirst et al., 2009), performance (Bommer et al., 2007), job satisfaction (Seibert et al., 2004), and turnover (Liu et al., 2012).

Similarly, in a university context, researchers are typically embedded in research groups or departments, which are in turn clustered in faculties and universities (Markman et al., 2009). Consequently, we can expect the subunit level to affect entrepreneurial activities or researchers' propensity to engage in such endeavors. In fact, though prior research has largely documented the impact of university characteristics on academic entrepreneurship, the literature has also alluded to the importance of the subunit level (Bercovitz & Feldman, 2008; Kenney & Goe, 2004; Louis et al., 1989; Stuart & Ding, 2006), but has provided limited evidence on the existence of a department level effect. Therefore, following assertions in the academic entrepreneurship literature, just as indications provided in the organizational behavior literature, we argue that subunit effects are at play in academic entrepreneurship and can be detected by employing a multilevel model. Specifically, we propose:

Hypothesis 1: The department level explains significant variance in entrepreneurial intentions (in addition to individual and university effects).

Research objective 2: Cross-level direct and moderation effects of department culture

Assuming that the department level plays a vital role in academic entrepreneurship, we subsequently aim at understanding which departmental characteristics may affect researchers' entrepreneurial intentions. In doing so, we focus on the cross-level direct and moderation effects of department culture.

Direct effect of department culture on entrepreneurial intentions

Organizational culture can be defined as a set of values and beliefs shared by members of the same organization, which influence their thoughts, feelings and behaviors (O'Reilly et al., 1991; Schein, 1985). Organizational culture provides a framework through which individuals internalize expectations about their roles and behaviors in the organization (Deshpandé & Webster, 1989). Prior research has explored the overall effects of organizational culture on diverse individual outcomes, including entrepreneurial behavior (e.g., Hornsby et al., 2002; Ireland et al., 2009). At the same time, scholars have widely observed the existence of distinct subcultures within an organization (Schneider et al., 2013; Trice & Beyer, 1993). Subcultures may develop within different departments, functional areas or work groups (Hofstede, 1998). As such, in addition to the influence of the overall organizational culture, organizational members are also affected by the value systems of the organizational subunits in which they are embedded (Adkins & Caldwell, 2004). Subsequently, in a university context, certain departments may have

cultural values that trigger academic entrepreneurship, while others may have a culture that inhibits researchers' entrepreneurial intentions.

A widely accepted and theoretically driven conceptualization, that covers the key dimensions of organizational culture as identified by Detert et al.'s (2000) literature review, is Quinn & Rohrbaugh's (1983) competing values framework. The framework calls attention to how opposing values exist in organizations or subunits, and how "different mixtures of values are reflected in both their desired ends as well as in their means to attain them, such as their structural designs and mechanisms of coordination and control" (Zammuto & O'Connor, 1992: 711). Four culture types – clan, hierarchy, market, and adhocracy - are differentiated according to whether organizations or subunits value flexibility and discretion versus stability and control, and whether they adopt an internal versus external orientation (Cameron & Quinn, 1999). As pointed out by Buenger et al. (1996), competing value sets differ from one subunit to another.

Of particular relevance in the context of our study is the adhocracy culture type (flexibility and external orientation), given its emphasis on innovation, creativity and risk-taking. A strong adhocracy culture occurs in dynamic organizations or subunits that can adapt rapidly when new circumstances arise (Cameron & Quinn, 1999). Accordingly, we expect university departments with adhocracy cultures to provide a setting where entrepreneurial intentions are more likely to arise among researchers. This is because the entrepreneurial process is fraught with difficulties, unforeseeable hazards and high levels of uncertainty (Nelson & Winter, 1982). Groen & Walsh (2013) indicate that in order to successfully commercialize technologies, entrepreneurs need to engage in activities which are difficult to manage, such as alliance management and open innovation, and have to creatively develop new business models. Subsequently, given the innovative and risk-oriented spirit which is likely to prevail in adhocracy-type departments, we expect entrepreneurial intentions to reside within such departments. Hence, we assume:

Hypothesis 2: A department's adhocracy culture is positively related to entrepreneurial intentions.

Moderation effects of department culture on entrepreneurial intentions

As we have contended so far, using a multilevel perspective, we expect department culture to affect academic entrepreneurship, over and above factors at other levels. Beyond the direct relation of department culture to entrepreneurial intentions, we draw upon trait activation theory (TAT) to conceptualize the moderation effects of department culture, as such building bridges between the individual and subunit level. TAT focuses on a person-situation interaction model to explain individual behavior as a response to relevant cues found in situations (Tett & Guterman, 2000). The underlying principle is that individuals are more likely to behave in a way consistent with their personality trait when the contextual influence at play is relevant to the trait (Hirst et al., 2009; Tett & Burnett, 2003). Applying TAT to our research objective, aimed at understanding the meaning of department culture for academic entrepreneurship, we can expect individuals possessing personality traits leaning towards entrepreneurship to especially behave consistently with these traits when their context fosters entrepreneurial behavior.

Following this logic, an important trait in our study is proactive personality, which refers to the enduring behavioral tendency of people to take action to influence their environment (Bateman & Crant, 1993). Individuals high in proactive personality "identify opportunities and act on them, show initiative, and persevere until meaningful changes occur" (Crant, 2000: 439). Proactive personality has been associated with positive outcomes across many domains, such as job performance (Thompson, 2005), career success (Seibert et al., 1999), and entrepreneurship

(Crant, 1996). Furthermore, prior studies have shown how organizations can provide cues that activate an individual's proactive personality, and related behavior (e.g., Erdogan & Bauer, 2005; Li et al., 2010).

As argued above, we identify adhocracy cultures as cultures which are, thanks to their flexibility and external orientation, supporting entrepreneurial activities. In such contexts, individuals possessing traits oriented towards entrepreneurship are more likely to (intend to) engage in entrepreneurial activities. Accordingly, we assume that the positive relationship between proactive personality and entrepreneurial intentions, as found by Crant (1996), also holds in a university context. However, consistent with the moderation implied by TAT, we argue that a departmental adhocracy culture may provide cues that bring out proactive personality and entrepreneurial intentions. Indeed, given that adhocracy cultures exemplify proactive strategies (Zammuto & O'Connor, 1992), according to TAT, the interaction between person and situation will stimulate proactive personality and behavior. Therefore, we contend that entrepreneurial intentions resulting from researchers' proactive personalities are more likely to occur in university departments with a strong adhocracy culture. Thus, we hypothesize:

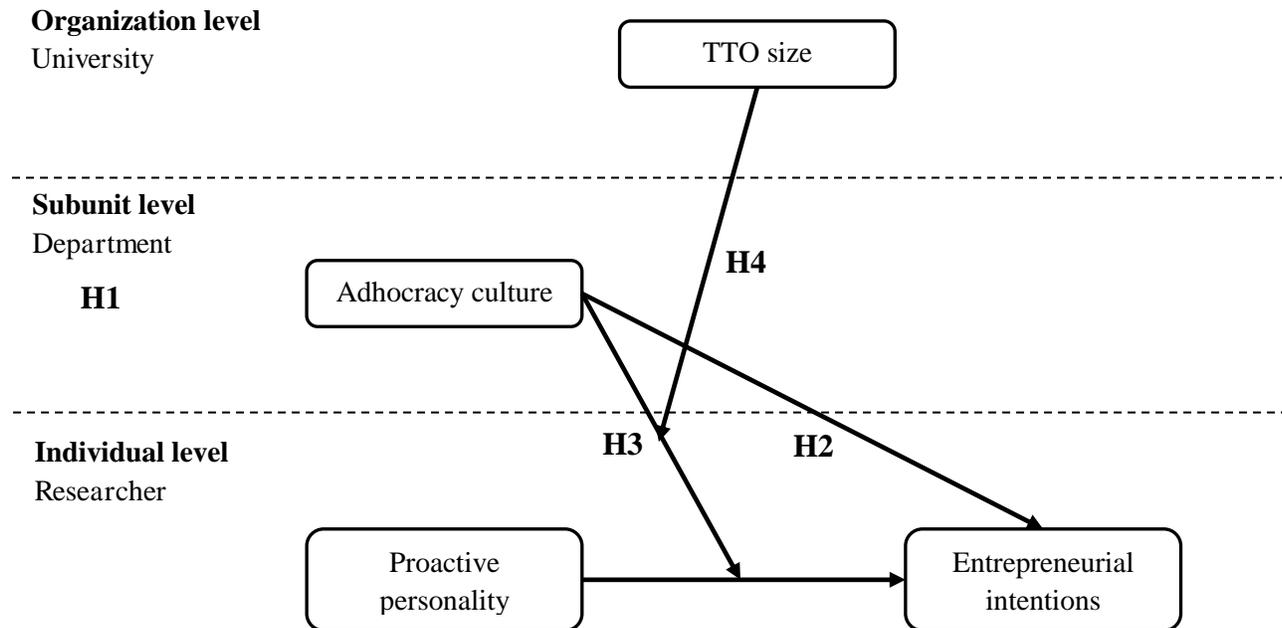
Hypothesis 3: A department's adhocracy culture moderates the positive relationship between proactive personality and entrepreneurial intentions, such that the effect is reinforced when a strong adhocracy culture is in place.

Alongside their embeddedness in subunits, individuals are part of the overall organization. Hence, contextual cues that trigger researchers' entrepreneurial traits can originate from the department level, as hypothesized above, but also from the university as a whole. We expect that, in addition to the activation of proactive personality through a department's adhocracy culture, resulting in higher levels of entrepreneurial intentions, university characteristics could further enhance this effect. Therefore, in what follows, we bring together the individual, subunit and organization level. Concretely, in line with TAT, we argue that the positive relation between proactive personality and entrepreneurial intentions will be reinforced if both the subunit and organizational context display an external orientation and thus stimulate entrepreneurship. This is because proactive individuals characteristically scan their environment for opportunities (Bateman & Crant, 1993), and such outward focus translates into greater entrepreneurial intentions (Crant, 1996). At the department level, adhocracy cultures are inherently characterized by an external orientation, in which prospecting for opportunities is valued (Cameron & Quinn, 1999). As for the university level, in response to the increasing emphasis on entrepreneurial activities, most universities have established dedicated TTOs (Markman et al., 2008). TTOs fulfill a boundary spanning role between academia and industry, or the university and its external environment (Ambos et al., 2008). In their boundary spanning activities, TTOs serve as a bridge between internal "suppliers" of research results (i.e. researchers or groups) and external "customers" (i.e. firms, entrepreneurs and venture capitalists) (Siegel et al., 2003). As such, the extent to which the university has an external orientation is manifested in the size of its TTO. Taken together, we argue that proactive researchers will possess even higher levels of entrepreneurial intentions if they are working in departments with a strong adhocracy culture which are part of universities with a large TTO. So:

Hypothesis 4: A university's TTO size and a department's adhocracy culture moderate the positive relationship between proactive personality and entrepreneurial intentions, such that the effect is reinforced when both a large TTO and strong department adhocracy culture are in place.

Figure 1 depicts the conceptual model for this study.

Figure 1: Conceptual model



We also included control variables at the individual (gender, entrepreneurial experience), subunit (entrepreneurial role models) and organization (university size, professor's privilege) levels.

METHODOLOGY

Data collection and sample

Our study is based upon cross-sectional data collected in 2012-2013 at 24 universities in five European countries. As starting point for our data collection, we used the cultural clusters put forward by the Global Leadership and Organizational Behavior Effectiveness research program (GLOBE) (Javidan et al., 2006) and selected the following countries: Sweden (Nordic Europe), Spain (Latin Europe), Slovenia (Eastern Europe), Germany and Belgium (Germanic Europe). For each country, we compiled a list of all universities by means of secondary sources (including reports by ministries of education, university rankings, technology transfer networks and general internet searches). Next, we selected two geographical regions within each country and contacted all universities through emailing or phoning their TTOs, asking for their participation in our research. Eventually, we received positive answers from 40 out of 58 TTOs contacted. Subsequently, we arranged face-to-face interviews with TTOs, in which stage another nine TTOs were not available or eventually not willing to participate, resulting in 31 TTOs offering full collaboration. Through these interviews, we obtained information on university and TTO characteristics. Primary data were verified and complemented with secondary data from annual reports, university and TTO websites. Furthermore, we asked permission and assistance to contact individual researchers from different scientific disciplines, which was not feasible in seven universities due to privacy rules or non-existence of staff directories.

The survey population consisted of 32,358 researchers. Respondents received a request through email to complete an online questionnaire, followed by a kind reminder after one week. We obtained 6,442 failure messages indicating that email addresses were invalid or our message

could not be sent, resulting in a usable population of 25,916 researchers. In total, 4,515 responses were received (or 17% of the usable population, which is comparable to previous research in this domain (Obschonka et al., 2012)). After elimination of incomplete responses and departments with less than two respondents or insufficient within-department agreement (i.e. $r_{wg(j)} < 0.70$; Bliese, 2000), our final sample consists of 2,652 researchers nested in 386 departments who fully completed the questionnaire, or 10% of the usable population. T-tests revealed no significant differences between respondents who filled in all questions and those who provided incomplete responses, or between early and late respondents, in terms of gender, age, human capital, discipline or country ($p > 0.05$).

Measures

Entrepreneurial intentions were assessed using the 6-item scale developed by Linan & Chen (2009) (1 = strongly disagree; 7 = strongly agree). Cronbach's alpha is 0.96, indicating high scale reliability (Hair et al., 2006). Proactive personality was measured using a shortened version of the Bateman & Crant (1993) scale, as validated by Seibert et al. (1999) (Cronbach's alpha 0.88). Adhocracy culture was captured with Cameron & Quinn's (1999) scale. To justify aggregation from the individual to the subunit level, first it was necessary to ascertain that there is little variance within departments in respondents' perceptions of adhocracy culture. A second prerequisite for aggregation was that there is variance across departments in perceptions of adhocracy culture. Both the mean value of inter-rater agreement ($r_{wg(j)} = 0.78$) and intra-class correlations (ICC(1) = 0.13; ICC(2) = 0.77) supported aggregating individual responses to the department level through calculation of the mean score (Bliese, 2000). TTO size is measured by the total number of FTE staff working at the university's TTO (including IP and licensing staff, excluding staff employed in science parks or incubator facilities), based upon interview data.

As our study aims at developing a multilevel model that incorporates the individual, subunit and organization level, we also deemed it necessary to include control variables at these different levels. At the level of the researcher, gender (0 = male, 1 = female) was controlled for as men are usually more entrepreneurial than women (Crant, 1996). Entrepreneurial experience indicates whether or not respondents have ever started or attempted to start their own business, including any self-employment (0 = no, 1 = yes). Prior entrepreneurial exposure has been found to relate positively to entrepreneurial intentions (Obschonka et al., 2012; Zhao et al., 2005). At the department level, entrepreneurial role models indicate whether the department has members who founded their own business (0 = no, 1 = yes). Researchers' entrepreneurial decisions are shown to be socially influenced (Bercovitz & Feldman, 2008), as the presence of entrepreneurial role models diminishes concerns about the social ramifications of own entrepreneurial actions (Stuart & Ding, 2006). At the university level, the natural logarithm of the number of academic staff is used as indicator of university size. Finally, the presence of *professor's privilege* in Swedish universities, which gives full ownership of intellectual property rights to researchers, was controlled for through inclusion of a dummy variable (0 = no, 1 = yes).

RESULTS

Analytical strategy

Table 1 presents the means, standard deviations, and correlations among the variables under study. The dependent variable of this study, entrepreneurial intentions, was operationalized at the individual level of analysis, while the independent variables were measured at the individual

(researcher), subunit (department), and organization (university) level. We used three-level HLM (Raudenbush & Bryk, 2002) to test our hypotheses. In contrast to OLS regression analysis, HLM explicitly accounts for the nested data structure and allows to simultaneously estimate the impacts of factors at different levels on individual-level outcomes, while maintaining appropriate levels of analysis for these predictors (Hofmann et al., 2000).

Table 1: Descriptive statistics and correlations

	Mean	SD	(1)	(2)	(3)	(4)
Level 1 – Individual (n = 2,652)						
(1) Gender ^a	0.49	0.50				
(2) Entrepreneurial experience ^a	0.17	0.38	-0.12			
(3) Proactive personality	4.83	0.90	-0.09	0.16		
(4) Entrepreneurial intentions	2.47	1.51	-0.19	0.37	0.37	
Level 2 – Subunit (n = 386)						
(1) Entrepreneurial role models ^a	0.79	0.41				
(2) Adhocracy culture	3.88	0.69	0.14			
Level 3 – Organization (n = 24)						
(1) University size	3.30	0.37				
(2) Professor's privilege ^a	0.33	0.48	-0.33			
(3) TTO size	15.00	18.11	0.36	0.11		

Pearson correlation coefficients (1-tailed), indicating significant correlations ($p < 0.05$) in bold

^a Correlations of binary variables should be interpreted with care.

Table 2: Hierarchical linear modeling (HLM) estimations of variance (Hypothesis 1)

Entrepreneurial intentions	Variance component	Percentage of total variance	d.f.	χ^2
Unconditional model				
Level 1 variance (between individuals)	2.12126	92.63%		
Level 2 variance (between subunits)	0.11552	5.04%	362	503.78***
Level 3 variance (between organizations)	0.05327	2.33%	23	60.98***

*** $p < 0.001$

n = 2,652 individuals (level 1), 386 subunits (level 2), and 24 organizations (level 3)

Research objective 1: Department level effects on entrepreneurial intentions

A fully unconditional model, a null model with no predictors, is used to examine the proportion of variance in entrepreneurial intentions attributable to each level of analysis, with particular interest in the subunit or department level. As illustrated in Table 2, the unconditional modeling partitions the total variance into three components: between individuals, between subunits, and between organizations. The analyses reveal that only 2.33 per cent of the variance in entrepreneurial intentions resides between universities, 5.04 per cent lies between departments within universities, and the largest percentage of variance, 92.63 per cent occurs at the individual level. However, the chi-squared test confirms that significant variance occurs across both departments and universities ($p < 0.001$). Since our data demonstrate sufficient between-department variance in entrepreneurial intentions, this provides support for Hypothesis 1.

Research objective 2: Cross-level direct and moderation effects of department culture

Now that we have empirical support that the department level plays a part in the academic entrepreneurial process, a necessary condition is fulfilled for our second research objective or assessing the role of specific departmental factors, such as culture, in researchers' entrepreneurial

intentions. Consequently, we tested the cross-level direct effect (Model 1) and moderation effects (Models 2 and 3) of a department's adhocracy culture, presented in Table 3.

As for the control variables included in our study, our findings are mostly consistent with prior research. In particular, at the individual level, we find that women possess lower entrepreneurial intentions than men ($p < 0.001$) (Crant, 1996; Zhao et al., 2005), and that entrepreneurial experience (Obschonka et al., 2012) and proactive personality (Crant, 1996) relate positively to entrepreneurial intentions ($p < 0.001$). Our data do not demonstrate a significant influence of entrepreneurial role models present within departments. At the university level, we find universities with the professor's privilege to be less conducive to researchers' entrepreneurial intentions ($p < 0.05$). Finally, we do not observe a direct effect of university nor TTO size.

Table 3: HLM unstandardized coefficients (robust standard errors in parentheses) (Hypotheses 2 – 4)

Entrepreneurial intentions	Model 1		Model 2		Model 3	
Level 1						
Intercept	2.525****	(0.126)	2.525****	(0.126)	2.525****	(0.122)
Gender	-0.331****	(0.051)	-0.333****	(0.051)	-0.328****	(0.051)
Entrepreneurial experience	1.266****	(0.065)	1.267****	(0.064)	1.267****	(0.064)
Proactive personality	0.493****	(0.030)	0.484****	(0.027)	0.477****	(0.030)
Level 2						
Entrepreneurial role models	-0.037	(0.115)	-0.037	(0.115)	-0.045	(0.111)
Adhocracy culture	0.164**	(0.068)	0.164**	(0.068)	0.124**	(0.059)
Level 3						
University size	-0.232	(0.183)	-0.232	(0.182)	-0.224	(0.190)
Professor's privilege	-0.227**	(0.096)	-0.227**	(0.096)	-0.220**	(0.097)
TTO size	-0.001	(0.002)	-0.001	(0.002)	-0.001	(0.002)
Level 1 x 2						
Proactive personality x Adhocracy culture			0.108*	(0.062)	0.074	(0.070)
Level 1 x 3						
Proactive personality x TTO size					0.001	(0.001)
Level 2 x 3						
Adhocracy culture x TTO size					0.006****	(0.002)
Level 1 x 2 x 3						
Proactive personality x Adhocracy culture x TTO size					0.003*	(0.002)
<hr/>						
R ² between-individuals	0.24		0.24		0.24	
R ² between-subunits	0.18		0.17		0.25	
R ² between-organizations	0.47		0.47		0.43	
R ² total	0.24		0.24		0.24	

* $p < 0.10$; ** $p < 0.05$; *** $p < 0.01$; **** $p < 0.001$

n = 2,652 individuals (level 1), 386 subunits (level 2), and 24 organizations (level 3)

° R² total = R² between-individuals x 92.63% + R² between-subunits x 5.04% + R² between-organizations x 2.33%

Turning to our hypotheses, Model 1 shows a positive direct relationship of departmental adhocracy culture on researchers' intentions to engage in entrepreneurial activities (0.164; $p < 0.05$), as predicted by Hypothesis 2. A precondition for testing cross-level interactions is that the slope coefficient of the relationship between proactive personality and entrepreneurial intentions varies across individuals. Results confirmed significant variance in the level 1 slope (variance = 0.04; $\chi(377) = 424.32$, $p < 0.05$). Subsequently, we include adhocracy culture as a moderator in Model 2. The positive and significant coefficient (0.108; $p < 0.10$) corroborates Hypothesis 3

that individuals' proactive personality leads to even greater entrepreneurial intentions when their department has a strong adhocracy culture. The graphical representation of the interaction pattern for the moderator at one standard deviation below and above the mean is presented in Figure 2.

Finally, we introduce the three-way-interaction in Model 3 and find support for Hypothesis 4, which proposed that adhocracy culture and TTO size are simultaneously reinforcing the positive link between proactive personality and entrepreneurial intentions (0.003; $p < 0.10$). Figure 3 visualizes this moderation effect.

Figure 2: Cross-level moderation effects of adhocracy culture on the relationship between proactive personality and entrepreneurial intentions (Hypothesis 3)

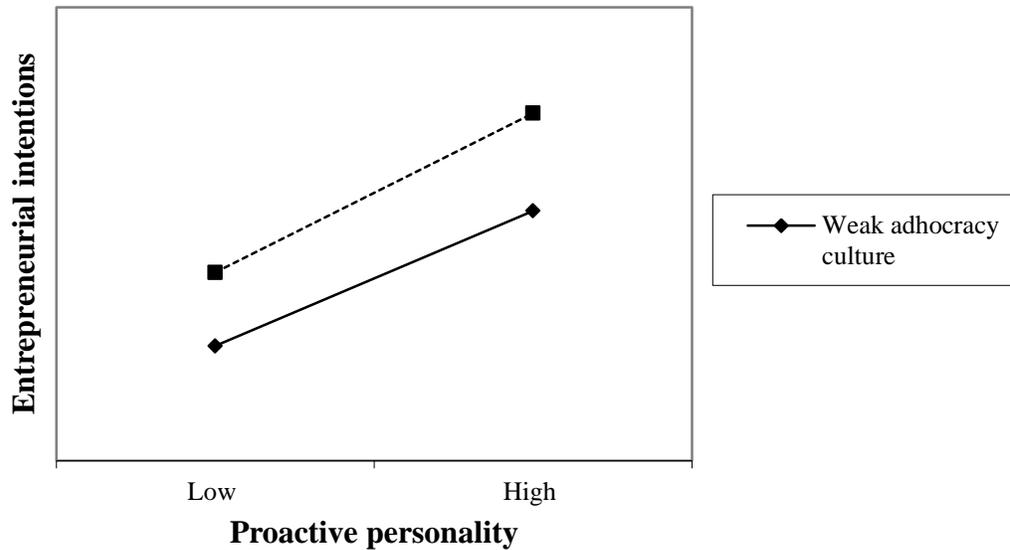
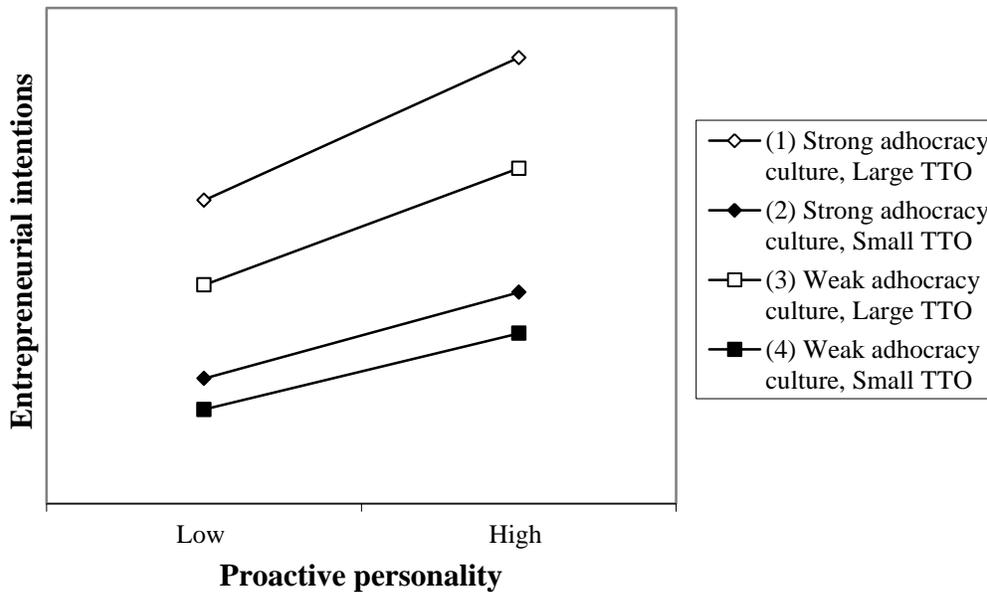


Figure 3: Cross-level moderation effects of TTO size and adhocracy culture on the relationship between proactive personality and entrepreneurial intentions (Hypothesis 4)



DISCUSSION AND CONCLUSION

The purpose of this paper was to provide more fine-grained insights into whether and how department membership affects academic entrepreneurship, through the use of multilevel analysis. First, drawing on a sample of 2,652 researchers from 386 departments in 24 European universities, our findings indicate that, in addition to the influence of the individual and the overall organization, the subunit or department level does matter for academic entrepreneurship. What is more, while the variation in entrepreneurial intentions between researchers was primarily dependent upon individual differences, the department effect outweighs the university effect. This observation is in line with Kozlowski & Klein's (2000: 20) notion of bond strength, or "the extent to which characteristics, behaviors, dynamics, and processes of one level or unit influence the characteristics, behaviors, dynamics, and processes of another level or unit", which increases with proximity. In view of that positive association, individuals are more likely to be influenced by their personal attributes, followed by subunit level characteristics, and then by organizational factors. Hence, we conclude that the department is at least as important as level of analysis as the university. Second, we identify a department's adhocracy culture as explanatory factor for entrepreneurial intentions in academia. Researchers working in departments with a value system that emphasizes flexibility and an external orientation, show a greater propensity to become an entrepreneur. Next to this cross-level direct effect, building on insights from TAT, we find a department's adhocracy culture to act as a moderator as well. In particular, researchers' proactive personality traits are more likely to be translated into entrepreneurial intentions in strong adhocracy cultures. Finally, our analyses also extend understanding of the interplay between individual, subunit and organizational antecedents of entrepreneurial intentions. A combination of a strong adhocracy culture at the department level and a large TTO at the university level reinforces the positive effect of a proactive personality on entrepreneurial intentions.

Our results have several implications for theory and practice. For academia, this paper makes a number of contributions to the (academic) entrepreneurship literature. First, our study presents a conceptual framework and related empirical validation that reflects the multilevel nature of entrepreneurship, which has been presented as a fundamental direction for future research by many scholars (Davidsson & Wiklund, 2001; Shepherd, 2011; Zahra & Wright, 2011). At the same time, we also respond to similar calls for contextualization, which have specifically been made in the literature on academic entrepreneurship (Djokovic & Souitaris, 2008; Lockett et al., 2005; Markman et al., 2008; Rothaermel et al., 2007). In particular, in contrast to the vast majority of studies describing single-level models, we adopt a multilevel lens and bridge the micro- and meso-level of analysis. Mapping out such cross-level relationships contributes to a more holistic understanding of (academic) entrepreneurship. Furthermore, this study overcomes the challenge to theorize multilevel effects (Kozlowski & Klein, 2000), by integrating insights from person-situation interaction theory. Second, our research extends previous academic entrepreneurship literature, which has predominantly focused on the organization as a whole (i.e. inter-university differences) and has almost neglected subunits (i.e. intra-university differences), by showing that departmental influences deserve closer scrutiny. Specifically, we provide empirical evidence that, beyond the individual-level effects, researchers' entrepreneurial intentions are primarily dependent upon departmental characteristics rather than university factors. Third, while the organizational behavior literature has underlined the importance of subcultures (Hofstede, 1998; Schneider et al., 2013; Trice & Beyer, 1993), so far, the entrepreneurship literature has largely overlooked the impact of the cultural values of

departments in which individuals reside. Our findings demonstrate that additional insights can be gained by considering the role of department culture when studying entrepreneurial outcomes, both directly and indirectly. Fourth, building upon TAT, our study identifies adhocracy culture as a contextual moderator for proactive personality, as such responding to calls by Crant (2000) and Erdogan & Bauer (2005) to explore how the relationship between proactive personality and behavioral outcomes may be dependent upon situations. Finally, we also contribute to the emerging stream of studies on entrepreneurial intentions in academia, by highlighting how these can emanate from the interaction between individual and context.

From a practical point of view, especially for university managers and policy makers, our examination of differences in entrepreneurial intentions across the three levels of analysis is valuable in order to assign their restricted resources to the most influential factors rather than peripheral ones. Given that the impact of the subunit level should not be underestimated, it may be desirable not to focus all efforts at the central university level, and to enlarge departments' autonomy to take initiatives that strengthen the entrepreneurial agenda. Further, recent studies have given attention to the different organizational structures that TTOs can take and how decentralized models, in which TTOs are operationally involved in departments have become more prevalent in universities (Bercovitz et al., 2001; Huyghe et al., 2014). By highlighting the impact of departments, our findings suggest that such decentralized TTO structures may be more conducive to entrepreneurial activities than merely centralized models. Specifically, through their interactions with industrial companies (i.e. potential customers, partners and suppliers) and research teams in other departments, decentralized TTOs could contribute to the development of externally-oriented cultures within departments, and thus enhance researchers' entrepreneurial intentions. Correspondingly, while policy makers have mainly provided funding for infrastructure at the central university level, including TTOs, science parks and incubators (Phan et al., 2005), it could be beneficial to partly shift their attention to the support of departments. In particular, our results suggest that government initiatives that are mainly targeted towards universities are likely to have a limited impact on encouraging entrepreneurial endeavors, unless they take better account of departmental influences as well as individual attributes of academics. Finally, our research also provides guidance for department heads seeking to encourage academic entrepreneurship. For instance, they could create an adhocracy culture by promoting risk taking and outward thinking, through their leadership style or by launching initiatives that stimulate researchers' active search for commercial opportunities (e.g., collaborations with other departments or institutions, participation in innovation clusters or technology transfer courses).

Our work has a number of limitations that raise opportunities for future research. First, our findings are based upon cross-sectional data, and therefore, we could not establish the causality of our results. Longitudinal research designs would enable to add a fourth level of analysis (i.e. temporal variation) in order to give attention to causal inferences and evolutions over time, and to assess the impact of context dynamics. Second, we deliberately focused on Quinn & Rohrbaugh's (1983) competing values framework and provide insights into the influence of a department's adhocracy culture. However, as numerous models have been developed in the organizational culture literature (Detert et al., 2000), we encourage future studies to employ alternative operationalizations or to concentrate on specific key dimensions of culture. Along the same lines, future research could borrow concepts and theoretical underpinnings from the broader organizational behavior literature, such as subunit climate (strength) (Schneider et al., 2013), in order to further disentangle the impact of the department level on entrepreneurial intentions. Finally, the generalizability of our findings outside the academic entrepreneurship

context warrants further research. For instance, future studies could assess to which extent our results hold for other explorative processes or behaviors, such as product innovation and corporate entrepreneurship, in settings where individuals are likely to be influenced by cues in their proximal environment and in the organization as a whole.

Despite these limitations, to our knowledge, our study is the first to delineate the multilevel attributes of academic entrepreneurship, thereby specifically focusing on the cross-level effects of department culture. We hope to inspire future studies to utilize multilevel theories and research designs in order to examine the intersection of the entrepreneurship and organizational behavior literatures.

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