CAN PERCEIVED SUPPORT FOR ENTREPRENEURSHIP KEEP GREAT FACULTY IN THE FACE OF SPINOUTS?

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ABSTRACT

Despite the recent increase in academic entrepreneurship research, we still know relatively little about the degree of involvement of academic inventors in university spinouts. In this study, we distinguish between academic inventors who leave the university after the creation of a spinout (academic exodus) and those who maintain their university affiliation (academic stasis). Drawing from the literature on innovation-supportive climates and from organizational support theory we argue that perceptions of institutional support and departmental norms regarding entrepreneurship are associated with the exodus versus stasis decision. We find that inventors who have higher perceptions of institutional support for entrepreneurship are less likely to leave. This relationship is enhanced by perceptions of favorable departmental norms towards entrepreneurship. We discuss the implications of our work for the literatures on academic entrepreneurship, innovation-supportive climates and perceived organizational support. Our study has clear policy implications for universities, policy makers and funders, who aim to stimulate academic entrepreneurship, but are concerned about losing entrepreneurial faculty.

INTRODUCTION

University spinouts involve the direct commercialization of intellectual property developed within a university. Several notable firms serve as classic examples of the phenomenon and include Hewlett-Packard, Genentech, Chiron and Google. Much research has been devoted to figuring out how to create a supportive university environment that would foster spinout creation (Shane, 2004; Djokovic and Souitaris, 2008; van Burg, Romme, Gilsing and Reymen, 2008; van Burg, Gilsing, Reymen and Romme, 2013). However, limited research has accounted for the fact that academic inventors interact with and perceive their organizational environment in different ways (van Burg et al., 2013).

In this study, we draw upon literature on innovation-supportive climates (Amabile et al., 1996; Somech and Drach-Zahavy, 2013; Zhou and George, 2001) and on organizational support theory (Eisenberger et al., 1986; Rhoades and Eisenberger, 2002; Riggle et al., 2009) to illustrate how varying perceptions of support for entrepreneurship affect an inventor's decision to stay in or leave the university. We distinguish between academic inventors that leave the university after the creation of a spinout and assume a full-time position in the new firm (a scenario we define as academic exodus) and those that maintain their university affiliation and have part time or little involvement with the venture (a scenario we define as academic stasis). The academic exodus versus stasis decision is important for universities, policy makers and funders. While there is increasing social pressure to commercialize university inventions, there is also a real concern about losing valuable academic talent.[1]

Specifically, academic stasis has a number of important advantages. Studies have found that people involved in spinouts are often highly published academics (Debackere, 1999). Therefore, when academics stay, universities retain their star researchers, who can continue their involvement with science. Moreover, academics staying in the university may

[1] More generally, organizational research is very interested in voluntary employee turnover. This pervasive interest comes from a recognition that voluntary turnover can be very costly, and that understanding and managing it can provide benefits (e.g., Griffeth & Hom, 2001; Maertz et al., 2007).

influence the behavior of others and thus inspire and mentor the next generation of academic entrepreneurs. Academics maintaining their university affiliation may also get involved in subsequent technology commercialization projects and become habitual spinout entrepreneurs (Westhead and Wright, 1998). Academic stasis may also lead to a change in the university reward structure which is currently based, to a considerable degree, on publications. Finally, it was recently found that spinouts lead by surrogate entrepreneurs (without the involvement of the academic inventor), surprisingly, outperform spinouts led by their academic inventors (Zerbinati, Souitaris and Moray, 2012).

On the other hand, there are also disadvantages to academic stasis. Inventors that stay in the university face time-constraints that can deny key contributions to the spinout and its investors. Stasis may give rise to tension between departments within the university which are 'successful' and 'unsuccessful' in technology transfer (Nelson, 2001). It may also create intra-departmental tension with other academics wishing they could be as financially successful as the academic entrepreneur. Moreover, academics that leave may provide valuable commercial contacts for the university.

In general, for all the above reasons, it is valuable for the stakeholders of the spinout process to gain a deeper insight into what predicts and explains academic exodus versus stasis. More broadly, the topic is also highly relevant for the innovation literature, which has recently signalled management of 'talent' as a research priority (Barczac, 2014).

In this study, we argue that perceptions of university support for entrepreneurship would be an important factor for the academic entrepreneurs' decision to stay or to go. A number of universities have embarked upon building a supportive environment for spinouts, offering encouragement and practical help at the level of the institution and the department. We focus, specifically, on *perceptions* of 'institutional support for entrepreneurship' (i.e. support by the university to create a spinout) and 'departmental norms regarding

entrepreneurship' (i.e. departmental norms about how desirable spinouts are) as predictors of an individual's exodus versus stasis decision. Regardless of the absolute level of support for entrepreneurship provided by a university, which is what a lot of the extant literature has focused on (e.g. Clarysse et al., 2005; Di Gregorio and Shane, 2003; Segal, 1986; Roberts and Malone, 1996), perceptions of support can vary significantly. Perceptions are important because they are more closely related to individual attitudes and behaviors than an actual situation (Amabile et al., 1996; Ostroff et al., 2005).

We survey individual academic inventors within a leading European university. Holding the university environment constant, we predict that academic inventors who perceive high institutional support for entrepreneurship will be less likely to leave the university. Moreover, we predict that the above relationship will be moderated by perceptions of departmental norms regarding entrepreneurship. Interacting perceptions of support at two levels (institution and department) is important because the role of the department has been relatively neglected in the academic entrepreneurship literature (Grimaldi et al., 2011; Rasmussen, Mosey and Wright, 2014)[2].

We ground these hypotheses, in two seemingly disconnected broader-theoretical streams: The literatures on innovation-supportive climates (Amabile, et al., 1996; Zhou and George, 2001; Somech and Drach-Zahary, 2013) and on perceived organizational support (Eisenberger et al., 1986). Climate for innovation is a concept of how far an organization's values and norms emphasize innovation (Anderson & West, 1998; West & Anderson, 1996; Somech and Drach-Zahavy, 2013). Conversely, Perceived Organizational Support (POS)

[2] Perceptions of support for university spinouts can also be situated at the national, regional and local-government levels. While the influence of these perceptions cannot be underestimated, it is impossible to study all of these factors in a single study. In this study we have focused on perceptions of institutional and departmental support because we believe that the decision to leave or stay with the academic job is more likely to be influenced by factors internal, than by factors external, to the university. Perceptions of support for academic entrepreneurship by broader social institutions, outside the university, might be more influential for the decision to start a spinout than for the decision to leave or stay with the university. We also considered perceptions of support at more micro-levels, such as the research institute or research group, but pilot interviews indicated that the institution and the department were the most influential resource-holding and decision-making levels at the focal institution.

refers to employees' "beliefs concerning the extent to which the organization values their contribution and cares about their well-being" (Eisenberger et al., 1986, p. 501). The literatures of innovation-supportive climates and POS are complementary for our purposes; they offer separate theoretical arguments, but they both point towards the same hypothesis regarding the exodus versus stasis decision. Specifically, the 'climates' literature explains stasis via an emphasis on job-satisfaction (i.e. staying as a self-serving act), whereas POS explains stasis via reciprocity, social-identification and recognition (i.e. staying to exchange care with care).

The first contribution of the study is to the *academic entrepreneurship* literature. Our study makes an important distinction between academics who stay in the university after the creation of a spinout and those who leave. In addition, although much research has focused on "getting the institutional environment right", there is less research that has looked at how institutional support is actually perceived. Holding the institutional environment constant, we find that the decision to leave or to stay in the university is related to variation in perceptions. Therefore, we show that not all academics are influenced by their institutional environment in the same way. Academics that are most influenced by it are precisely those that are most likely to stick around the university in the longer term and continue with their research programme.

The study also contributes to *organization support theory* in two ways: First, we extend the discussion on specific domains of support (i.e. support for what?), by introducing the concept of organizational support for entrepreneurship. Second, we extend the recent discussion on specific sources of support (i.e. support by whom?) by distinguishing between institutional and departmental sources of support and exploring how the effects of support by the department moderate the influence of institutional support on the likelihood of pursuing academic stasis.

Finally, the study contributes to the literature on *innovation supportive climates* by empirically linking perceptions of a supportive climate with employee retention. In this respect, there has been very little empirical work investigating the influence of perceived climate for innovation on retention (Holtom et al., 2008). In addition, scholars have advocated the need for studies examining the interactive effect of departmental and institutional factors on employee retention (Holtom et al., 2008).

THEORETICAL DEVELOPMENT

Academic Entrepreneurship

The fast growing literature on academic entrepreneurship has uncovered a lot about why spinouts are created (see recent special-issue reviews by Lockett et al., 2005; Siegel, Wright and Lockett, 2007; Gulbransen et al., 2011). Broadly speaking, drivers of spinout creation include public policy and the technology regime (macro-level factors), institutional support (meso-level), and the characteristics of the inventors (micro-level) (Djokovic and Souitaris, 2008). However, despite the growth in the size and the quality of the literature, we still know little about what keeps academic inventors in the university, in the face of spinouts (Nicolaou and Birley, 2003).

To tackle this issue, we zoomed into the voluminous literature of meso-level studies focusing on how institutional support impacts spinout creation (Rothaermel et al., 2007). Scholars have linked spinout creation with, among others, the university's policy on equity and royalties (Di Gregorio and Shane, 2003), the level of support provided by universities (Roberts and Malone, 1996; Clarysse et al., 2005), the organizational culture (Segal, 1986), the support by technology transfer offices (George, 2005), the university's intellectual eminence (Di Gregorio and Shane, 2003; Sine et al., 2003), and the intellectual property regime (McSherry, 2001).

Despite much research on institutional support for spinout creation, we do not know how people actually perceive this support infrastructure. As Bercovitz and Feldman (2008) elegantly put it, "The question remains as to whether the message received (from the institution) differs systematically across individuals, and/or over time, and how this affects the diffusion of the initiative. Future research that investigates these issues is clearly warranted" (p. 86). In this study, we depart from the literature that institutional support facilitates spinout creation and introduce the role of the individual (i.e. different people perceive this support differently).

Based on the literature on innovation-supportive climates and on organizational support theory, we propose that these differences in perceptions of support for entrepreneurship affect the inventors' decision to stay in the university or to leave with their spinout. The two literature streams of innovation-supportive climates and POS offer separate, but complementary theoretical arguments, which point towards the same direction regarding the academic exodus versus stasis decision. Specifically, innovation-supportive climates predict stasis based on the principle of job-satisfaction (a self-serving act as faculty like their work environment), while POS predicts stasis based on the principles of reciprocity, identification and recognition (exchanging care with care). While the two theoretical arguments explain the focal decision from two separate angles ("I stay to keep my creative job" versus "I stay to be part of a university that supports me"), they both increase the inventors' socio-emotional needs and their satisfaction with the current state of affairs. We elaborate on these theoretical mechanisms in the following sections.

Innovation-supportive climates

'Climate for innovation' is concerned with how an organization's values and norms emphasize innovation (Anderson & West, 1998; West & Anderson, 1996; Somech and Drach-Zahavy, 2013). Similar constructs include the 'work environment for creativity'

(Amabile, et al., 1996) and the 'perceived organizational support for creativity', defined as "the extent to which organizations are seen as encouraging, respecting, rewarding, and recognizing employees who exhibit creativity" (Zhou and George, 2001; p.684).

This literature stream has argued that perceptions of a supportive climate for innovation and creativity make employees more innovative. Climate either acts as a direct predictor of innovation (e.g. Scott and Bruce, 1994) or as a moderator; for example, Somech and Drach-Zahavy (2013) found that climate for innovation moderates the relationship between employee creativity and innovation implementation. Innovation-oriented climates have also been empirically linked with higher levels of satisfaction and commitment (Odom, Boxx, & Dunn, 1990).

However, the link between perceptions of a climate for innovation/creativity and employee retention is not yet well-investigated empirically. With the exception of one study that found that turnover intention (not actual turnover) is reduced for individuals whose work climates complemented the creative requirements of their jobs (Shalley, Gilson and Blum, 2000), there is surprisingly little empirical evidence directly linking perceived climate for innovation/creativity with actual turnover (Holtom et al., 2008).

We contribute to this line of reasoning by arguing that creative workers (e.g. academic inventors) would *appreciate* a supportive climate for innovation, which would lead to lower turnover. Our core construct, *perceptions of institutional support for entrepreneurship*, is the extent to which inventors perceive that their institution encourages and supports them to engage in entrepreneurship. Since perceived support for entrepreneurship (in a university context) is conceptually similar to perceived climate for innovation and creativity (in a broader sense), we utilise the innovation support climate literature as the first theoretical basis to ground our hypotheses. Specifically, we argue that perceptions of institutional support for entrepreneurship would lead to higher job satisfaction

and reduced faculty turnover via three psychological mechanisms, perceived attainability of the goal, feelings of participative safety, and beliefs about the intrinsic value of the project. We elaborate below.

An innovation-supportive climate provides an organizational vision, namely "an idea of a valued outcome, which represents a higher order goal and motivating force at work" (West, 1990; p.310). In congruence with goal-setting theory (Locke and Latham, 1990), an organizational vision increases the perceived attainability of the goal and enhances the creative employees' commitment, focus and direction (Somech and Drach-Zahavy, 2013). In our context, perceived institutional support for entrepreneurship would increase the perceived attainability of a successful spinout among academic founders, leading to higher effort and job satisfaction and a reduced likelihood of exit.

An innovation-supportive climate also offers participative safety, which denotes a non-threatening atmosphere replete with trust and support (Somech and Drach-Zahavy, 2013). Since implementing innovation via a successful spinout is a process full of obstacles, academic inventors need to feel safe in order to persist in the face of adversity. Therefore, participative safety would be highly appreciated by spinout faculty, leading to higher job satisfaction and lower turnover.

Finally, an innovation-supportive climate would increase the belief of academic inventors about a higher intrinsic value of their project (Amabile et. al., 1996). In turn, belief of a higher value of their work would increase the founders' willingness to work even harder (Somech and Drach-Zahavy, 2013). This positive spiral would raise job satisfaction and subsequently reduce the probability of exiting the university.

Overall, based on the literature on innovation-supportive climates, we argue that entrepreneurial faculty who feel supported by their institution would particularly enjoy their work in the university and appreciate their freedom to be creative. This, in turn, increases job

satisfaction and the probability of academic inventors staying in the university rather than leaving with their spinout. Based on the above line of theoretical arguments, the stasis decision would be an act of self-interest (the faculty are satisfied with their academic job and do not want to give it up).

Organizational support theory

Organizational support theory predicts that three general forms of perceived favorable treatment received from the organization - fairness, supervisor support, and organizational rewards and job conditions - increase POS (Rhoades and Eisenberger, 2002). POS is raised because actions taken by agents of the organization are often viewed as indications of the organization's intent (rather than of the agents' personal motives) and are attributed to discretionary choice (rather than circumstances beyond the organization's control) (Levinson, 1965; Rhoades and Eisenberger, 2002). Organizational support theory also predicts that POS has positive consequences both for employees (e.g., heightened positive mood) and for the organization (e.g., increased affective commitment and performance, reduced turnover).

The bulk of the literature on organizational support focused on general perceptions of support by the organization as a whole (POS) (see Eisenberger et al., 2001; Maertz et al., 2007). The terms "global" and "general" appear very often in the theory's vocabulary (e.g. Eisenberger et al., 1986; Rhoades and Eisenberger, 2002). Organizational support theory has not examined in detail the impact of *POS for specific domains* (i.e. support for something) (Takeuchi et al., 2009). Among the few pioneering studies in this direction, Guzzo et al. (1994) adapted the general construct of POS (Eisenberger et al., 1986) to assess POS of expatriate managers in specific domains (job assignment, off-the job life, and plans for repatriation). Moreover, Scott and Bruce (1994) and Zhou and George (2001) introduced perceived organizational support for creativity, although these studies are more connected to the literature stream on innovation-supportive climates rather than to the POS stream. In a

similar vein, we focus on *perceptions of institutional support for entrepreneurship*, namely the extent to which inventors perceive that their institution encourages and supports them to engage in entrepreneurship.

POS for specific domains can be associated with the theoretical apparatus of organizational support theory on the assumption that the specific supported domain is valued by the employees and contributes to their socio-emotional needs. This is a reasonable assumption in our context; we sampled spinout inventors who proved with their actions (disclosing their invention and founding a university spinout) that they are interested in entrepreneurship. For them, university support for entrepreneurship should be highly valued and contribute to their socioemotional needs. This is because in a supportive environment for entrepreneurship, the substantial amount of 'extra' work to commercialize the invention by setting up the spinout is appreciated by the university (rather than seen as a destructive side-activity aimed at personal benefit). In addition, spinout inventors know that the level of support for entrepreneurship varies in different universities and is a discretionary choice. Not all universities choose to demonstrate the same commitment and support towards academic entrepreneurship. Therefore, it is plausible that spinout inventors would value a supportive environment for entrepreneurship at their university, feeling that the university 'cares' about their interests and needs.

An organizational support explanation of the exodus versus stasis decision: Reciprocity, Identification and Recognition.

Organizational support theory addresses the psychological mechanisms underlying the consequences of POS. The primary explanation of the negative effect of POS on the intention to leave the organization is the *reciprocity norm*. On the basis of the reciprocity norm, POS should produce a felt obligation to care about the organization's welfare and to help the organization reach its objectives (Eisenberger et al., 2001). The obligation to exchange caring

for caring (Foa & Foa, 1980) enhances employees' affective commitment to the personified organization (Cropanzano and Mitchell 2005; Rhoades and Eisenberger, 2002). In the spinout context, faculty who perceive that the university supported them to start their venture would also feel that they have to reciprocate the favour, by staying in the university to continue their research programme.

Moreover, the caring and respect connoted by POS should fulfil socio-emotional needs such as affiliation and emotional support (Armeli et al., 1998; Eisenberger et al., 1986). This would lead employees to incorporate organizational membership and role status into their *social identity* (Rhoades and Eisenberger, 2002). Applying the *identification* principle to our context, a high perceived level of institutional support for entrepreneurship, might enhance academic entrepreneurs' identification with the university 'brand'. The latter would subsequently reduce the likelihood of them leaving the university when the spinout is created. Inventors who identify with the university brand would also perceive positive *reputational benefits* for their spinout from their personal association with the university, which will further increase their likelihood of staying.

In addition, POS strengthens employees' beliefs that the organization *recognizes* and *rewards* increased performance (Rhoades and Eisenberger, 2002). Applying the *recognition principle* to the spinout context, faculty who perceive a high institutional support for entrepreneurship, would also perceive that their extra efforts to commercialize their technology are recognised by the university. Academics that feel recognised for being entrepreneurial would have a higher likelihood of exchanging the complement and participating in the spinout while retaining their faculty position.

Our core thesis

In summary, innovation-supportive climates would predict that faculty prefer to stay in the university to serve themselves (because they enjoy their creative work-environment

and want to keep their job). Instead, POS theory would predict that faculty prefer stasis to remain part of the institution that supported them, exchanging care with care. Regardless of which mechanism is more prevalent (we cannot establish that with our current data), they both point towards the same direction. The two theoretical lines are related in that, while they explain the focal decision from two different angles, they ultimately both increase the inventors' socio-emotional needs and their satisfaction with the current state of affairs. Both lines expound contentment with the status quo. At the same time, the two lines complement each other in that, similar to many other human decisions, the focal decision of academic exodus versus stasis is made by considering both the self *and* the relationship with others – the climate argument primarily deals with the former and the POS argument with the latter. Both arguments increase an inventor's belief that staying in the university is the right decision. We put forward the following research hypothesis:

Hypothesis 1: The higher an inventor's perceptions of institutional support towards entrepreneurship, the greater the likelihood that she or he will choose to stay in the university.

The effect of perceived supportive departmental norms for entrepreneurship

A current drawback of both the POS and innovation-supportive climates literatures is that they conceptualize the organization as one entity. *Specific sources of support* (e.g. from supervisors, work teams, departments) have received limited attention in the POS literature (Maertz et al., 2007; Hayton et al., 2012) because their effect on organizational outcomes were thought to be fully mediated through general POS (Eisenberger et al., 2002; Rhoades et al., 2001); however, specific sources of support could have their own independent effects on outcomes (Maertz et al., 2007). Similarly, there is a lack of research examining innovation-supportive climates at different organizational levels. Our study extends recent work on

specific sources of support, by exploring the effects of perceived departmental norms towards entrepreneurship (defined as the extent to which faculty perceive that their department encourages them to engage in entrepreneurship). We believe that a distinction between institutional and departmental perceptions of support has wide theoretical importance, because it would apply not only to spinouts, but also to most large organisations.

The literature on academic entrepreneurship has indicated that supportive norms at the departmental level would play a role in the successful commercialisation of academic research (e.g. Doutriaux, 1991; Bercovitz and Feldman, 2008; Kenney and Goe, 2004). However, the influence of the department in the spinout phenomenon is still an empirically under-researched area (Rasmussen et al., 2014). Louis et al. (1989) argued that behavioural expectations are reinforced at the departmental level, on the top of what happens at the level of the institution and found a relatively strong effect of local norms on individual behaviour. This is particularly so because universities are loosely coupled systems (Weick, 1976). Similarly, Kenney and Goe (2004) found evidence that the department is often the relevant community of practice as far as academic entrepreneurial activity is concerned by examining the Electrical Engineering and Computer Science departments at Stanford and UC Berkeley.

A recent study by Rasmussen et al. (2014) has illustrated that universities can develop institutional level practices to support spinouts, but those would be insufficient unless they are reinforced by departmental practices, 'on the ground'. Often, heads of departments are provided with institutional resources to support spinout creation, but the allocation of these resources is at their discretion. Departments can vary on how enthusiastically they endorse university rhetoric favoring entrepreneurship and how strictly they apply institutional support policies (for example regarding sabbaticals, proof of concept funding and IP support). The situation at the department level would have profound implications on the effect of institutional support for entrepreneurship on spinout outcomes

(Rasmussen et al., 2014). In line with these findings, we argue that departments which are perceived to be aligned with the broader university regarding the spinout agenda would reinforce the institutional message. In this case, the positive relationship between perceived institutional support and stasis would become stronger in the presence of perceived departmental norms towards entrepreneurship. Instead in departments that are more decoupled from the broader university, a 'schism' could be created between what the university supports regarding spinouts and what is considered good practice by departmental faculty. This situation would dilute (moderate) the effect of perceived institutional support for entrepreneurship on individual action[3].

The idea of departmental norms moderating the effect of institutional climate is also supported by broader literature on organizational subcultures. Research on organizational culture has observed the possibility of distinct subcultures within an organization, which can develop within different departments or work groups (Hofstede, 1998; Trice and Beyer, 1993; Schneider, et al., 2013). As such, the effect of the overall organizational culture on individual outcomes, interacts with the effect of the value systems of the organizational subunits in which organizational members are embedded (Adkins and Caldwell, 2004; Boisnier and Chatman, 2003).

Based on the above arguments we expect that high perceptions of institutional support for entrepreneurship, coupled with high perceptions of departmental norms towards entrepreneurship, would encourage academic entrepreneurs to stay in the university. Expressed more formally:

[3] It is important to note that we are not arguing for a main effect of perceived departmental norms on the likelihood that an academic will choose to stay in the university. Although the department is crucial, it remains a unit within the broader university context. Spinout policy is usually developed at the university level. If the official university policy is entirely geared against spinouts with no supportive infrastructure in place, the university would be unlikely to generate spinouts irrespective of how supportive a particular department might be. Similarly, the norms at the departmental level should be seen in conjunction with the climate in the broader university rather than in isolation. In sum, we argue that an inventor's perceptions of departmental norms cannot directly influence the decision to stay or leave, but can still affect this decision by moderating the relationship between perceptions of institutional support and stasis.

Hypothesis 2: Perceptions of departmental norms towards entrepreneurship moderate the relationship between perceptions of institutional support and the likelihood of choosing to stay in the university. Specifically, the positive relationship between perceived institutional support and stasis becomes stronger in the presence of perceived departmental norms.

METHODOLOGY

Sample

The sample for this study includes all the inventors involved in a spinout from a leading European university, which is considered world-class for science, engineering and medicine. As with most European institutions, the university owns the intellectual property to all inventions discovered by academics. As a result, the decision to form a spinout rests solely with the university (which through its equity committee always gives inventors an equity stake in the spinout). This is important because it highlights that spinout creation and the exodus/stasis decision are not simultaneously made, and that they are made by different entities[4].

The study was conducted at a point in time when spinout activities were becoming widespread in the university. Almost all of the spinouts were relatively young since it was only recently that the university has been actively engaged in promoting this phenomenon. The university's commercialization policy was mostly geared towards spinout creation rather than alternative commercialization routes.

Our sample consists of 111 inventors from 45 spinouts. We had pilot tested the questionnaire using the concurrent pilot-testing interview technique (Dillman, 2000) with 14 individuals. At the time the inventors received the questionnaires they had already become involved in a spinout and had also made the decision to stay in the university or to leave.

[4]Selection bias could have arisen if these two decisions were simultaneously as the error terms of the substantive and the selection equation would be correlated (i.e. $\rho \neq 0$) (Heckman, 1976, 1979, 1990; Lee, 1982).

Ninety-nine questionnaires were returned, yielding a response rate of 89%. After eliminating questionnaires with missing data and doctoral students who were not actively involved in the spinout this gave a final usable sample of 89 individuals [5].

Econometric model

We used (i) hierarchical clustered logistic regressions and (ii) conditional (fixed-effects) logit models[6]. The models account for the nested nature of our data in the following ways. In the clustered logistic regressions, all the inventors in each spinout belonged to the same cluster. This model relaxes the independence assumption and requires only that the observations are independent across clusters (spinouts). The model generates robust standard errors with an additional correction for the effects of clustered data (Long and Freese, 2001). The conditional logit models are used to control for all unobserved spinout effects and hence for entrepreneurial opportunity in each spinout (Chamberlain, 1980, Hsiao, 2003). The likelihood is estimated relative to each spinout (stratum) because the model is only identified in the "within" dimension of the data (Pendergast et al., 1996). These models not only account for the nested nature of the data but also, for each spinout, academics that left the university are matched against those that stayed in the university; in spinouts where there is no variation in the exodus versus stasis decision, there is no addition to the conditional log-likelihood as these individuals are automatically dropped from the calculation[7]. Conditional logistic regression is computationally the same in the following 3 analytical scenarios (StataCorp., 2011): (i) fixed-effects logistic models for panel data, (ii) matched case-control

[5] For an academic to be classified as being involved in a spinout she or he must be classified by the technology transfer office as an inventor of the technology being commercialized via the university spinout and must be a co-founder holding equity in the spinout.

[6] The general specifications of the conditional logit models are given by $P(y_{it}=1|\chi_{it})=\Phi(\chi_{it}\beta+\gamma_i)$, where Φ is the cumulative logistic distribution, $i=1,2.....n$ denotes the spinout, $t=1,2,.....T_i$ denotes the individuals in the *ith* spinout, while the γ_i capture unobserved heterogeneity across the spinouts (Chamberlain, 1980; Baltagi, 2001; Wooldridge, 2002; Hsiao, 2003).

[7] We do not use a probit model as this is not suitable for a fixed-effects treatment due to computational complications associated with conditional maximum likelihood estimation (Maddala, 1987; Baltagi, 2001). We have also refrained from using a random effects model as this would assume that γ is independent of x and omitted variable bias would not be eliminated.

studies primarily conducted by bio-statisticians (Hosmer and Lemeshow, 2001) and (iii), McFadden's (1974) choice model.

Measures

Exodus and stasis.

The dependent variable was coded as "0" if the inventor was still employed by the academic institution (academic stasis) and "1" if the inventor had left the university (academic exodus) to concentrate *fully* on the spinout and not go to another university. Since most of the spinouts were very young at the time of the survey (many were just created), inventors were also coded as "1" if they were planning to leave the university within the following year. In this latter case, we confirmed that academics who responded that they would leave did eventually leave the university. To avoid the problem of common-method bias, we verified the validity of the dependent variable independently of the questionnaire, by crosschecking with the technology transfer office and with the company websites.

Perceptions of Institutional support for entrepreneurship.

Because organizational support theory did not examine the impact of POS for *specific domains* (Takeuchi et al., 2009) we constructed the measure of perceptions of institutional support for entrepreneurship with the following six items (see appendix). The first item emphasized the importance of management training following Birley (1993) and Chiesa and Piccaluga (1998). The second item was adapted from Kassicieh et al. (1996) to capture whether the university encouraged inventors to become actively involved in the commercialization of their technology. The third and fifth items attempted to examine the importance of the technology transfer office (Thursby et al., 2001; Siegel et al., 2007). The fourth item attempted to measure the extent to which the university was supportive of academics wishing to spinout (Roberts and Malone, 1996; Kassicieh, et al., 1996, 1997). The sixth item was adopted from Kassicieh and colleagues' (1996, 1997) to capture sources of

business assistance within the university. Respondents were asked to signify agreement to six statements on a 5-point Likert scale, ranging from strongly disagree to strongly agree.

Perceptions of Departmental norms towards entrepreneurship.

We constructed four items to measure perceptions of departmental norms (see the appendix). Respondents were asked to signify agreement on a 5-point Likert scale. The first item examined whether academics in the respondent's department consider that spinouts impede the publication of research. The second examined whether academics in the respondent's department did not look favorably on other academics forming spinouts (Doutriaux, 1991). The third and fourth items examined whether spinouts were considered viable and desirable in the respondent's department (Kenney and Goe, 2004).

Control variables

Opportunity Cost. Amit et al. (1995) argued that the greater the opportunity cost the lower the likelihood that someone will be involved in entrepreneurial activity. To control for opportunity cost (Hamilton and Harler, 1994), we created two control variables. (i) *Academic Seniority.* While Shane and Khurana (2003) found that academic rank increased the likelihood of spinout creation, we expected that academic hierarchy would increase the opportunity cost of leaving academia. We assigned a value of 5 for a full professor, 4 for a reader, 3 for a senior lecturer, 2 for a lecturer and 1 for research associate or doctoral student. (ii) *Articles.* We counted the total number of refereed articles published during the past 4 years. We expected that high-performing academics would have a higher opportunity cost to leave the profession and therefore a higher likelihood of stasis.

Age. We controlled for age as older academics may be less likely to leave the university (Borjas and Bronars, 1989; Bates, 1995; Parker, 2009).

Principal Investigator status. Principal investigators that have a high contribution to a joint invention are more likely to feel an emotional attachment to their invention (Rivlin, 2003). As

a result, they are more prone to leave the university to exploit their invention. We created a dummy variable taking the value of 1 if an inventor was the principal investigator (PI) in the project and 0 otherwise.

Team size. Team size has important implications in the firm organizing process (Shane, 2003). We controlled for team size expecting that with less co-inventors to share the firm, a focal inventor would be more temped to exit from the university to exploit the invention.

Technology class. We also controlled for technology class as this may affect the commercialization potential (Cohen and Levin, 1989; Shane 2001b; Nerkar and Shane, 2003a, 2003b; Shane, 2004). We constructed three dummy variables to capture the following categories: (i) biotechnology, (ii) software/IT and (iii) novel techniques in medicine-including instrumentation, diagnostics and robotics ('Others' was the excluded reference group). It is important to note that technological opportunity of individual spinouts is controlled for more efficiently through the use of conditional logistic regressions.

Gender. We also controlled for gender, as studies have found significant differences in entrepreneurial behavior between men and women (Carter et al., 2003; Bird and Brush, 2002; Parker, 2009).

Risks to science. We expected inventors perceiving involvement with industry as a risk to science (Bok, 1982) to have a lower likelihood of exiting the university. Seven items were taken from Louis et al. (1989) to identify the extent to which involvement with industry represented a potential risk to traditional scientific values (see appendix 1).

Instrumentality of wealth. To control for financial incentives underlying an inventors' decision to get involved in a spinout (Shane, 2004: 158; Parker, 2009), we utilized three statements that Birley and Westhead (1994) used in their taxonomy of business start-up reasons (see appendix 1).

Start-up experience. We included a variable capturing prior start-up experience expecting those with prior start-up experience to be more likely to exit the university.

Entrepreneurial values. We included a variable capturing entrepreneurial values (Bird et al., 1993) expecting those associated with such values to be more likely to pursue academic exodus. Two items were taken from Bird et al. (1993) including "I prefer the faster feedback of the industrial world over academe" and "knowledge is best embodied in a finished marketable product or service".

Chairperson. We controlled for whether the respondent held the position of a chairman or chairwoman in the spinout.

Academic values. We included a variable capturing identification with traditional academic values. Four items were taken from Bird, Hayward and Allen (1993) including "knowledge creation is best measured by scholarly publications and presentations" and "I value acceptance in scholarly circles" (see appendix 1).

RESULTS

Table 1 presents the means, standard deviations and variable correlations. The VIFs ranged between 1.10 and 2.61. As these numbers were lower than 10, multicollinearity is unlikely to be a problem in the study (Belsley et al., 1980).

Exploratory and confirmatory factor analyses. We conducted a principal components factor analysis with Varimax (orthogonal) rotation (Hair et al., 1998). Seven factors were extracted which showed remarkable similarity to the theoretical dimensions – only the seven items capturing 'risk to science' loaded on two distinct factors (see Table 2). These two sub-dimensions were labeled 'risk to traditional scientific standards' and 'risk to scientific progress'. The extracted factors accounted for 73.1% of the total variance and there were no cross-loadings. The Kaiser-Meyer-Olkin measure of sampling adequacy was 0.70 and

Bartlett's test of sphericity was 1325.64 ($p<0.001$). We also conducted a confirmatory factor analysis which further confirmed the results of the exploratory factor analysis (please see Appendix 2 for details).

Insert Tables 1 and 2 about here

Construct reliability. All items loaded significantly on the factors, thus indicating *convergent validity* (Anderson and Gerbing, 1988). With respect to construct reliability, we report three reliability indices (see table 3). First, Cronbach's alphas (Cronbach, 1951) were above the recommended minimum of 0.70 (Nunnally, 1978) for internal consistency. Second, we computed Bagozzi's (1980) construct reliability index. Values for all variables were above the threshold of 0.70. Third, we utilized Fornell and Larcker's (1981) $p_{vc(\eta)}$. All constructs had values greater than or equal to 0.50 (apart from academic values), which meant that the variance captured by each construct was greater than the variance attributed to measurement error.

Insert Table 3 about here

Discriminant validity. Each construct's $p_{vc(\eta)}$ significantly exceeded the squared correlation with the other constructs thereby indicating discriminant validity (Fornell and Larcker, 1981).

Econometric results. Table 4 reports the logistic regression results. Model 1 presents the base model that includes the control variables. The coefficient for academic seniority is negative and significant ($p<0.01$), which establishes that academic rank is negatively associated with exodus. The coefficient for start-up experience is positive and significant ($p<0.05$), which establishes that prior start-up experience is positively associated with exodus; however, this variable does not retain its significance in the other models. In model 2, the perceptions of institutional support and departmental norms are introduced. The coefficient for perceptions of institutional support is negative and significant ($p<0.01$) thus lending support to the hypothesis 1. The pseudo-R^2 increases from 0.155 to 0.241. In model

3, we introduce the interaction variable between perceptions of institutional support and departmental norms. The coefficient of this variable is negative and significant ($p<0.01$) thus lending support to hypothesis 2. The pseudo-R^2 increases from 0.241 to 0.399.

Insert Table 4 about here

To investigate further the nature of the interaction effect, we generated a series of simple regression equations following the guidance of Cohen and Cohen (1983), Aiken and West (1991) and Jaccard (2001). We plotted the predicted log odds for academic exodus for different combinations of perceptions of institutional support and departmental norms. We investigated the marginal effects of perceptions of institutional support on the likelihood of academic stasis, conditioning on different levels of departmental norms (Brambor, Clark and Golder, 2006; Song and Chen, 2014). We used five different scores for perceptions of departmental norms, corresponding to 1 standard deviation (s.d.) below the mean, 0.5 s.d. below the mean, the mean value, 0.5 s.d. above the mean, and 1 s.d. above the mean. Figure 1 shows this interaction effect. Consistent with hypothesis 2, high perceptions of institutional support coupled with high perceptions of departmental norms decrease the likelihood of academic exodus (predicted log odds = -3.18).

Insert Figure 1 about here

Table 5 reports the results of the conditional (fixed-effects) logistic regressions[8]. Model 1 is the base model that includes perceptions of institutional support and departmental norms. The coefficient of perceptions of institutional support is negative and significant and establishes that the variable is negatively associated with academic exodus. McFadden's pseudo R^2 measure was 0.37. Model 2 adds the interaction term. McFadden's pseudo R^2 measure increased to 0.64. This term is negative and significant lending support to the second

[8] Since the model is identified only through the 'within' dimension of the data (i.e. within each spinout), a number of people are automatically dropped as they do not contribute to the conditional likelihood (leaving us with a sample size of 48 for this analysis).

hypothesis. Overall, the use of the fixed-effects (conditional) logit models corroborated the results of the logistic regressions[9].

Insert Table 5 about here

To alleviate concerns for a reverse relationship we tested for endogeneity by utilising an instrumental variables two-stage least squares regression (2SLS). The two instruments that we used were role modelling[10] and team size (significantly correlated with perceptions of institutional support at 0.25 and -0.28 respectively). The first stage of the instrumental variables probit regression involved regressing the purported endogenous variable on the instrumental variables plus the other controls. This yielded a fitted value for the endogenous variable (perceptions of institutional support). This fitted value was used in the second stage regression to replace perceptions of institutional support. We then used a Wald test to test for the exogeneity of the instrumented variable. The test was not significant ($p>0.05$) indicating that the null hypothesis of exogeneity could not be rejected. This implies that our estimates of the non-instrumented regression we reported earlier were more appropriate than the instrumented variable regression.

Robustness checks. We run a number of robustness checks using alternative operationalizations of our control variables (i) We coded the academic seniority variable as 4 for full professor, 3 for reader and senior lecturer, 2 for lecturer and 1 for research associate or doctoral student so as to resemble the US academic system. (ii) We examined another operationalization of this variable to capture the US-notion of tenure with 1 denoting a "professor, reader or senior lecturer" and 0 denoting a "lecturer, research associate or doctoral student"; (iii) We controlled for years since the highest educational qualification achieved to capture the years of research experience of the academic; (iv) We bundled four variables

[9]We did not conduct any further analyses (such as including control variables) with the conditional logit model in order to avoid small sample and sparse data biases that are associated with this model (Peduzzi et al., 1996; Greenland et al., 2000) .

[10] Three items were used to measure the role modelling effect. These were adapted from Rich's (1997) role modelling scale - please see appendix for items. Cronbach's alpha was 0.90.

related with opportunity costs – *Faculty versus post-doc/doctoral student, Articles, Seniority, and Age* - into one factor. We standardized and averaged the four variables (so that they are equally weighted). The results were robust across all four operationalizations above.

We also examined an alternative categorization of academics involved in university spinouts. Academics that left were coded in the same manner as before (i.e. exodus) but those who stayed (stasis) were divided into two groups. First, those who were actively involved in the spinout ("hybrid entrepreneurs") were operationalized as staying in the university but having a chairmanship, directorship, membership of the scientific advisory board, or a managerial position in the spinout. And second, those who were not actively involved in the spinout ("lab entrepreneurs") were operationalized as staying in the university and having just a consultancy position or no position in the spinout (in this later case the academics do still have equity in the spinout). We re-run our models using ordered logistic regressions (where 1 is a lab entrepreneur, 2 is a hybrid entrepreneur and 3 is an exodus entrepreneur) and our results held. That is, the negative relationship between perceptions of institutional support and the degree of spinout involvement became stronger in the presence of perceptions of departmental norms towards entrepreneurship.

Because of the large number of control variables and the fairly small sample size we also run the following additional robustness checks. We started from a basic model that included technology class, age, gender, articles and the three independent variables (institutional, departmental and the interaction term) and run every possible regression combination of the additional control variables. In total we run 1,023 different simulations. The results with respect to the three independent variables of interest remained the same. In general, logistic regression estimates are fairly robust to relaxation of the common guidelines for sample sizes (Vittinghoff and McCulloch, 2006) and “situations commonly arise where

confounding cannot be persuasively addressed without violating the rule of thumb" Vittinghoff and McCulloch (2006: 717).

DISCUSSION

At the outset of this project, we observed that the literature on academic entrepreneurship did not focus on why some inventors leave the university with their spinout whereas others stay. Since the exodus versus stasis decision has important implications for the university and other spinout process stakeholders this paper is an attempt to fill this void. We departed from existing empirical evidence that institutional support facilitates spinout creation and noted that different people might perceive this support differently. We investigated whether perceived institutional support and departmental norms for entrepreneurship underlie the exodus versus stasis decision. We found that the inventors who have higher perceptions of institutional support for entrepreneurship are more likely to stay in the university (hypothesis 1). Moreover, we found that the positive relationship between perceived institutional support and the decision to stay becomes stronger in the presence of favorable departmental norms towards entrepreneurship (hypothesis 2).

Interestingly, the interaction is disordinal in form (Lubin, 1961). Figure 1 shows that under low perceived departmental norms for entrepreneurship, the relationship between perceived institutional support and exodus becomes positive. How can this result be explained? Under less favourable departmental norms, the academic inventors would be unhappy with the culture in their immediate environment (the department). We believe that the more they would seek, receive (or just perceive) institutional support, the more confident they would become in the value of their firm and the higher the likelihood of taking the leap to entrepreneurship. During this process, academic inventors would realise that their aspirations do not fit with their departmental culture and their everyday professional life

would deteriorate as a result of their actions. Consequently the probability of leaving their academic job would be raised.

Our paper makes the following contributions. First, in line with recent literature that highlights the heterogeneity of university–industry interaction (Bercovitz and Feldman, 2008; Ding and Choi, 2011; Gulbrandsen et al., 2011; Perkmann and Walsh, 2008) we make a distinction between academic entrepreneurs with part-time involvement ('scholars at heart') and their more 'commercial' peers who give up their academic career to focus on the spinout (exodus). Since the two types of academic entrepreneurs are different, the implication for the spinout literature is that we have to look at their activities separately or comparatively.

Second, although much research has been devoted to "getting the institutional environment right", there is no research that has looked at how institutional support is perceived. Holding the institutional environment constant, we show that academics that are most influenced by institutional support are precisely those that are most likely to stick around the university in the longer term (and continue researching). Supportive climates for innovation and organizational support theory are alternative theoretical frameworks to explain the spinout phenomenon, which complement the existing resource-based and human-capital views (Lockett and Wright, 2005; Moray and Clarysse, 2005; Mosey and Wright, 2007). We illustrated that perceptions are important and we believe that a perception of support lens could be applied to explain other key entrepreneurial decisions such as the decision to start the spinout and the decision to look for venture capital.

Third, our study contributes to the broader POS and supportive climates for innovation literatures. The bulk of the literature on POS deals with general organizational support. The influence of POS in different domains has yet to be examined in detail (Takeuchi et al., 2009). By focusing on perceived support for a specific domain (entrepreneurship), we hope to encourage other scholars to study specific domains of support

('support for what?'). Moreover, in the current POS literature the organization is mostly perceived as one entity. We made a distinction between perceived support at institutional and departmental levels and illustrated that the two types of support have separate effects. The concept of perceived support at the departmental level can apply not only to universities but to most large organizations. More broadly, we believe that the sources of organizational support (support from where?) is a fruitful avenue for future POS research. In addition, we contribute to the literature on innovation supportive climates by empirically linking perceptions of a supportive climate (in our context for entrepreneurship) with low employee turnover. While a relationship between perceptions of support and low turnover is intuitive, empirical support was missing from the extant literature. We also address the call for additional work assessing the interactive impact of departmental and organizational factors on turnover (Holtom et al., 2008). Our results show that low perceived departmental norms could even dilute the positive influence of perceived institutional support on employee retention.

Finally, as entrepreneurship involves the nexus of valuable opportunities and enterprising individuals (Venkataraman, 1997; Shane and Venkataraman, 2000), disentangling the influence of individuals from the influence of technological opportunities is of prime importance in the development of the field (Bercovitz and Feldman, 2008). This study makes a methodological step in this direction through the use of team data and conditional (fixed-effects) logit models, which control for technological opportunity in each particular spinout. This is important because robust analysis of individual level factors that characterize entrepreneurs is difficult, because they are confounded by the influence of entrepreneurial opportunities (Shane and Venkataraman, 2000). Indeed, as Shane (2003:268) argues, "if researchers fail to control for the effect of opportunities when measuring the effects of individual differences on the likelihood of opportunity exploitation, then the

variance attributed to motivation might actually be artifact of the unobserved correlation between the motivation and the expected value of the opportunity".

Our study also has clear policy implications for universities that engage in academic entrepreneurship. What can universities do to stimulate spinout activity without losing faculty? We advise universities to a) offer support to academic inventors to spinout, and b) market and monitor the support in a customer-friendly manner, in order to ensure that the inventors' perceptions of support are favourable. More importantly, universities should look out for inconsistencies between a supportive environment for entrepreneurship at the level of the institution and unfavourable norms towards entrepreneurship at the departmental level. In such departments, the main effect is reversed: supporting academics to spinout at the institutional level will increase the likelihood of them leaving the university.

In theoretical terms, we advise the university to pursue an aggregation strategy (Pratt and Foreman, 2000) that aims to retain both a research and commercialization identity while building strong links between them. Organizational identity encapsulates the enduring and distinctive beliefs about an organization (Albert and Whetten, 1985; Gioia, Schultz and Corely, 2000; Gioia et al., 2010; Ravasi and Schultz, 2006; Hoang and Gimeno, 2010). In general, there have been few empirical studies investigating multiple organizational identities (Foreman and Whetten, 2002). Because identity congruence can have a significant impact on members' commitment towards the organization (Foreman and Whetten, 2002) it is important that universities strategically manage the plurality and synergy (Pratt and Foreman, 2000) between the different organizational identities that often co-exist in academic institutions.

Our study has three main limitations. Firstly, we cannot *empirically* prove that the perceptions of support caused the decision to stay rather than that the decision caused these perceptions. In the face of this problem we do not claim causality but instead we hypothesize an association between perceptions of support and the exodus/stasis decision. We note

however, that while there are ample *theoretical* reasons why perceptions of organizational support affect voluntary employee turnover (e.g. Rhoades and Eisenberger, 2002; Riggle et al., 2009), there are no known reasons for the reverse relationship. Moreover, the use of instrumental variables probit showed that the null hypothesis of exogeneity for perceptions of organizational support could not be rejected.

Secondly, our focus on a single site raises issues of external validity. We had decided to follow the approach of other studies on spinouts that investigated a single university e.g. Shane, 2001a, 2001b; Roberts, 1991; Hsu, Roberts and Eesley, 2007; van Burg et al., 2008; George, 2005; Feldman and Desrochers, 2003. Such an approach ensures a high degree of internal validity albeit at the expense of external validity. There was a specific reason for selecting this approach; we aimed to focus on varying perceptions of organizational support controlling for the actual provision of support, and therefore a single site was suitable.

Third, our study may suffer from omitted variable bias. For example, we have not controlled for other psychological factors that may influence the exodus or stasis decision such as extraversion, need for achievement and overconfidence, and have no information on investors` equity in each spinout. In this sense, we are aligned with the major explications of organizational support theory (e.g., Eisenberger et al., 1986; Shore and Shore, 1995), which prioritises actions by the organization that influence POS over dispositional variables (Rhoades and Eisenberger, 2002).

Conclusion. We believe that the distinction between academic exodus and stasis is important in better understanding academic entrepreneurship. Our core and interesting finding is that perceived support for an activity (entrepreneurship) that is intuitively linked with leaving one's job, actually makes faculty to stay in the university. From the university's point of view, supporting its scholars to pursue commercial activity, which on the face of it could 'derail' their research and lead to exit, actually makes these scholars more likely to remain

and keep researching. We hope that our findings contribute to a better understanding of the phenomenon of academic entrepreneurship.

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Table 1: Descriptive Statistics, Correlations and Variance Inflation Factors

Variable	μ	s.d.	VIF	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
1. Biotechnology	0.35	0.48	2.12																			
2. Software / IT	0.37	0.49	2.54	-.42**																		
3. Novel techniques in medicine	0.16	0.37	1.90	-.32**	-.33**																	
4. Risk to scientific progress	2.51	0.74	1.63	.04	-.08	.02																
5. Risk to traditional scientific standards	2.48	0.76	1.31	.02	.21*	-.24*	.07															
6. Instrumentality of wealth	2.73	1.20	1.44	-.05	.20	-.24*	-.13	.13														
7. Gender	0.06	0.23	1.27	-.08	.12	-.11	-.06	-.14	.23*													
8. Team size	3.99	3.46	1.97	-.34**	.57**	-.07	-.09	.21*	.21*	-.01												
9. Principal investigator	0.39	0.49	1.10	.14	-.14	-.03	.07	-.07	-.05	-.10	-.03											
10. Perceptions institutional support	0.00	1.18	1.51	.16	-.26*	.13	-.13	-.00	-.03	-.09	-.28**	.06										
11. Perceptions departmental norms	0.00	0.99	1.42	-.05	.29**	-.03	-.14	.04	-.14	.08	.35**	-.03	-.11									
12. Perceptions institutional X perceptions departmental	-0.12	1.19	1.35	.15	-.17	.08	-.02	.09	-.05	-.05	-.16	-.03	.41**	-.10								
13. Age	42.63	9.41	1.92	.27*	-.16	.09	-.04	-.17	-.03	-.12	-.24*	.03	.12	.04	.08							
14. Articles	18.66	20.07	2.05	.15	-.21*	.05	-.05	-.24*	-.10	.07	-.16	.11	.10	-.11	-.06	.30**						
15. Academic Seniority	3.16	1.70	2.61	.31**	-.21*	-.00	-.08	-.21*	-.11	-.05	-.24*	.02	.22*	.01	.18	.60**	.59**					
16. Academic values	4.24	0.63	1.69	.36**	-.24*	.02	-.03	-.06	.16	-.02	-.20	.10	.31**	-.18	.10	.38**	.39**	.38**				
17. Entrepreneurial values	3.00	1.06	1.78	-.26*	.31**	.01	-.52**	.10	.07	-.05	.20	-.01	-.03	.15	-.02	.01	-.11	-.10	-.10			
18. Chairperson	0.04	0.21	1.21	.07	-.05	-.09	.05	-.12	.03	-.05	-.11	.05	.13	-.09	-.02	.10	.26*	.11	.11	-.21		
19. Start-up experience	0.04	0.21	1.17	-.16	.17	.06	.14	-.03	-.07	-.05	.14	-.06	-.24*	.09	-.16	-.12	-.08	-.05	-.17	.00	-.05	
20. Stasis/Exodus	0.33	0.47	----	-.06	.11	-.04	-.08	.17	.02	.04	.14	-.02	-.35**	.13	-.47**	-.19	-.20	-.36**	-.16	.14	-.04	.08

*= Significant at $p < .05$; **= Significant at $p < .01$ (two-tailed test).

Table 2: Exploratory factor analysis

	Factor 1 Perceptions Institutional Support	*Factor 2 Perceptions Departmental Norms*	*Factor 3 Instrumentality of wealth values*	*Factor 4 Risk to traditional scientific standards*	*Factor 5 Academic values*	*Factor 6 Risk to scientific progress*	*Factor 7 Entrepreneurial values*
INST1	***.768***						
INST2	***.823***						
INST3	***.862***						
INST4	***.851***						
INST5	***.907***						
INST6	***.881***						
DEPAR1		***.818***					
DEPAR2		***.739***					
DEPAR3		***.914***					
DEPAR4		***.789***					
FIN1			***.897***				
FIN2			***.891***				
FIN3			***.868***				

RISKB1				***.663***			
RISKB2				***.879***			
RISKB3				***.803***			
RISKB4				***.733***			
ACA1					***.673***		
ACA2					***.726***		
ACA3					***.821***		
ACA4					***.637***		
RISKA1						***.608***	
RISKA2						***.771***	
RISKA3						***.863***	
ENT1							***.802***
ENT2							***.846***
Eigenvalue	*5.054*	*3.539*	*3.058*	*2.649*	*2.056*	*1.533*	*1.125*
% ofvar	*19.438*	*13.610*	*11.763*	*10.189*	*7.910*	*5.897*	*4.328*
Cumulative % var	*19.438*	*33.048*	*44.812*	*55.000*	*62.910*	*68.807*	*73.135*

Table 3: Construct reliability measures

	Cronbach's α	***Bagozzi'sρ***	***Fornell and Larcker$\rho_{vc(\eta)}$***
Perceptions Institutional support	*0.93*	*0.93*	*0.69*
Perceptions Departmental norms	*0.85*	*0.86*	*0.60*
Instrumentality of wealth	*0.88*	*0.88*	*0.72*
Risk to scientific progress	*0.79*	*0.80*	*0.58*
Risk to traditional scientific standards	*0.78*	*0.80*	*0.51*
Entrepreneurial values	*0.78*	*0.80*	*0.67*
Academic values	*0.71*	*0.74*	*0.42*

Table 4: Clustered-effects logistic regressions

Variables	*Model 1*	*Model 2*	*Model 3*
Biotechnology	.687	.462	.513
	(.757)	(.827)	(1.012)
Software / IT	-.161	-.332	-.831
	(.928)	(.804)	(1.158)
Novel tech. in medicine	.018	.396	.749
	(.913)	(1.126)	(1.316)
Risk to scientific progress	-.325	-.484	-.501
	(.431)	(.534)	(.698)
Risk to traditional scientific standards	.445	.639*	.955*
	(.322)	(.352)	(.491)
Instrumentality of wealth	-.136	-.143	-.340
	(.193)	(.218)	(.234)
Gender	.880	.642	1.505
	(.984)	(.988)	(1.382)
Team size	.049	-.035	-.003
	(.118)	(.152)	(.197)
Principal investigator	.020	.088	.016
	(.543)	(.493)	(.440)
Age	.025	.006	.005
	(.035)	(.041)	(.048)
Articles	.006	.002	-.023
	(.018)	(.017)	(.031)
Academic Seniority	-.637***	-.576**	-.446*
	(.221)	(.224)	(.252)
Academic values	-.199	.278	.390
	(.561)	(.528)	(.850)
Entrepreneurial values	.152	.234	.441
	(.275)	(.281)	(.338)
Chairperson	.567	.991	1.604
	(1.159)	(1.149)	(2.023)
Start-up experience	1.304**	.619	-.407
	(.639)	(.537)	(1.098)
Perceptions Institutional Support		-.816***	-.804**
		(.313)	(.371)
Perceptions Departmental Norms		.254	-.067
		(.307)	(.306)
Perceptions Institutional Support X Perceptions Departmental Norms			-1.538*** (.485)
Constant	-.109	-1.420	-3.049
	(3.323)	(3.304)	(4.405)
N	89	89	89
Log likelihood	-47.493	-42.615	-33.788
Wald X^2	57.36***	61.28***	65.96***
Pseudo R^2	.155	.241	.399

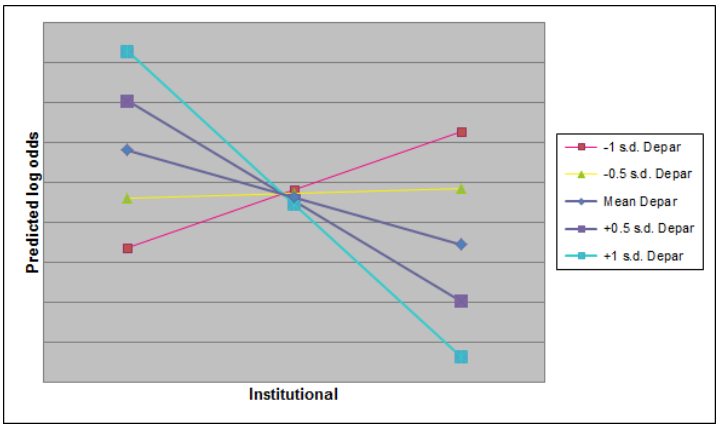
Note: Standard errors are in parentheses.
* p< .10 ; ** p< .05 ; *** p< .01

Table 5: Conditional (fixed-effects) logit models

Variables	*Model 1*	*Model 2*
Perceptions Institutional Support	-1.169***	-1.292*
	(.398)	(.670)
Perceptions Departmental Norms	-.318	.170
	(.527)	(.634)
Perceptions Institutional Support X Perceptions Departmental Norms		-1.352*
		(.546)
N	48	48
Log likelihood	-12.94	-7.34
X^2	14.89***	26.09***
$\Delta\chi^2$		11.20***
McFadden's pseudo R^2	.37	.64

Note: Standard errors are in parentheses.
* p< .10 ; ** p< .05 ; *** p< .01

Figure 1: Interaction effects



Appendix 1

Multi-item scales.

Scale items for perceived institutional support and perceived departmental support
The following question is related to your perceptions of the environment in the university you are or were affiliated with. The first part of the question focuses on the *university level* and the second part on the *departmental level*.

University level. Please indicate your agreement or disagreement with the following statements: (5-point likert scale ranging from "strongly disagree" to "strongly agree"):

1. The university offers good management training to academics wishing to spinout.
2. The university encourages inventors to get actively involved in the commercialization of their technology.
3. The technology transfer office offers significant advice for the establishment of spinouts.
4. The university is supportive of inventors wishing to be involved in a spinout.
5. The technology transfer office offers strong procedural guidance in setting up a spinout.
6. There are good sources of assistance within the university if one is interested in launching a venture to commercialize university research.

Departmental level. Please indicate your agreement or disagreement with the following statements: (5-point likert scale ranging from "strongly disagree" to "strongly agree") (the first three statements were reverse-coded)

1. Academics in my department consider that spinouts impede the publication of academic research.
2. Academics in my department do not look favourably on other academics forming spinouts.
3. Spinouts are not considered a viable technology transfer mechanism in my department.
4. Spinouts are regarded as desirable by academics in my department.

Scale items for risks to science
Please indicate, in your view, the degree of potential risk that involvement with industry presents to traditional scientific values: (4-point scale ranging from "no risk" to "great risk")

1. Creates pressure for faculty members to spend too much time on commercial activities.
2. Shifts too much emphasis toward applied research.
3. Undermines intellectual exchange and cooperative activities within departments.
4. Creates conflict between faculty members who support and those who oppose such activities.
5. Alters the standards for promotion.
6. Reduces the supply of talented university teachers.
7. Creates unreasonable delays in the publication of new findings.

Scale items for instrumentality of wealth
To what extent the following factors were important in your decision to get involved in the spinout? (5-point scale ranging from "to no extent" to "to a very great extent")

1. to give myself and my family greater security
2. to contribute to the welfare of my relatives
3. desire to have higher earnings

Scale items for entrepreneurial values
(5-point scale ranging from strongly disagree to strongly agree).

1. I prefer the faster feedback of the industrial world over academe.
2. Knowledge is best embodied in a finished marketable product or service.

Scale items for academic values
(5-point scale ranging from strongly disagree to strongly agree).

1. My work involves knowledge creation.
2. Knowledge creation is best measured by scholarly publications and presentations.
3. I value acceptance in scholarly circles.
4. I enjoy research with students.

Scale Items for role modelling
Other academics who have been involved in a spinout (5-point scale with anchors “to no extent” to “to a great extent”).

1. Have provided a good model for me to follow.
2. Have set a positive example for others to follow.
3. Have acted as a role model for me.

Appendix 2

Confirmatory factor analysis:

Following the exploratory factor analysis we conducted a confirmatory factor analysis. (Anderson and Gerbing, 1988: 412; Li and Atuahene-Gima, 2002; Atuahene-Gima and Li, 2002). Bentler and Chou (1987) recommend that the ratio of sample size to the number of parameters in confirmatory factor analysis should be at least 5:1. Therefore, and following the practice of a number of studies (e.g. Bentler and Chou, 1987; Doney and Cannon, 1997; Li and Atuahene-Gima, 2002; Atuahene-Gima and Li, 2002) we conducted the analysis of two separate sub-models.

To evaluate the models, Kline (2005) recommended the use of the chi-square, the root-mean-square error of approximation (RMSEA), the comparative fit index (CFI) and the standardized root mean square residual (SRMR) indices. In addition, Marsh et al. (1988) suggested the Tucker-Lewis (TLI) index (also known as the non-normed fit index), which is relatively independent of sample size and relatively robust against departures from normality (Joreskog and Sorbom, 1982).

In the first model, the chi-square statistic was 111.79 (p=0.10) and the RMSEA was 0.046. The CFI was 0.97, the IFI was 0.97, the SRMR was 0.09, and the TLI was 0.96. In the second model, the chi-square statistic was 57.71 (p=0.01) and the RMSEA was 0.089. The CFI was 0.97, the IFI was 0.97, the SRMR was 0.07, and the TLI was 0.96. These results are shown in Tables 1A and 1B.

Values above 0.90 for the comparative fit index are considered a good fit to the data (Kelloway, 1998). Similarly, a value of 0.96 in both models for the Tucker-Lewis (TLI) index is above the recommended value of 0.90 (Kelloway, 1998). In addition, values of the standardized root mean square residual (SRMR) "less than .10 are generally considered favorable" (Kline, 2005: 141). Also, values above 0.95 for the incremental fit index are considered a very good fit to the data (Hu and Bentler, 1999). Moreover, the error variances of the indicators were significant. In this respect, "nonsignificant error variances usually suggest specification errors, since it is unreasonable to expect the absence of random error in most managerial and social science contexts" (Bagozzi and Yi, 1988: 75).

Table 1A: Confirmatory factor analysis – A

Item Description	***Standardized Loading***	***t-value***
Perceived instrumentality of wealth		
FIN 1	*0.86*	*9.63*
FIN 2	*0.89*	*10.00*
FIN 3	*0.79*	*8.44*
Risk to science A: Risk to scientific progress		
RISK A1	*0.67*	*6.51*
RISK A2	*0.90*	*9.35*
RISK A3	*0.71*	*6.99*
Risk to Science B: Risk to traditional scientific standards		
RISK B1	*0.61*	*5.91*
RISK B2	*0.92*	*9.75*
RISK B3	*0.71*	*7.06*
RISK B4	*0.57*	*5.46*
Entrepreneurial values		
ENT1	*0.89*	*8.21*
ENT2	*0.75*	*6.92*
Academic values		
ACAD1	*0.55*	*5.01*

ACAD2	*0.60*	*5.51*
ACAD3	*0.88*	*8.08*
ACAD4	*0.50*	*4.51*
Model Fit Index χ^2*=111.79 (p=0.10), NNFI(TLI)=0.96, CFI=0.97,* *IFI=0.97 RMSEA=0.046 SRMR=0.09*		

Table 1B: Confirmatory factor analysis – B

Item Description	***Standardized Loading***	***t-value***
Perceptions of institutional support		
INST 1	*0.70*	*7.00*
INST 2	*0.80*	*8.37*
INST 3	*0.87*	*9.52*
INST 4	*0.82*	*8.73*
INST 5	*0.92*	*10.42*
INST 6	*0.88*	*9.79*
Perceptions of departmental norms		
DEPA 1	*0.73*	*7.20*
DEPA 2	*0.67*	*6.51*
DEPA 3	*0.97*	*10.82*
DEPA 4	*0.72*	*7.18*
Model Fit Index		
χ^2=57.71 (p=0.01), NNFI(TLI)=0.96, CFI=0.97, IFI=0.97 RMSEA=0.089 SRMR=0.07		