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Exploring Academic Women's Engagement in Entrepreneurship: an Institutional Perspective

ABSTRACT

Despite increasing research on women entrepreneurs understanding of female entrepreneurship remains limited in specific environments such as universities. Whilst the number of women academics has grown in recent decades, their engagement in commercialisation activity remains limited. Progress with respect to their institutional status, individual rank or scientific productivity is not reflected in their involvement in the commercialisation of scientific knowledge through spin-off/start-up creation.

Adopting an institutional framework research reported here seeks to identify factors influencing low participation rates in commercialisation activities. A multi-case design is used to explore macro, meso and micro factors in the context of the Universities of Edinburgh (Scotland) and Granada (Spain). Information rich, in-depth interviews with female academic entrepreneurs and those responsible for Technology Transfer Offices and incubators in both universities are employed to develop a multi-perspective account. The interplay between positive and negative influences on entrepreneurship at the macro, meso and individual levels is considered through exploration of specific cases from within each institution. Implications of the findings for theory, university policies and would-be academic entrepreneurs are considered in the conclusion to the paper.

INTRODUCTION

Academic entrepreneurship is one of the most popular topics in entrepreneurship research; however, there have been few advances with respect to women's entrepreneurship within the university sector. Whilst recent decades have seen significant growth in the number of female academics, their engagement in spin-off formation remains limited (Rosa and Dawson, 2006; Lowe and González-Brambila, 2007; Landry *et al.*, 2006). Moreover, improvements with respect to the institutional status of academic women, their individual rank and scientific productivity are not similarly reflected in their involvement in the commercialisation of science via spin-off creation (Murray and Graham, 2007).

Exploration of the extent of women's engagement in commercialisation through disclosures and patents, as well as research on factors which influence the establishment of university start-ups, highlights three main types of inhibiting factor. First, structural factors, which include the lower presence of women academics in those scientific areas more closely associated with applied research (Whittington and Smith-Doerr, 2005) or apparent barriers to the advancement of women into senior positions (Bailyn, 2003). Second, factors associated with accessing resources, whether financial, human or those of social capital (Mosey and Wright, 2008; Stephan and El-Ganainy, 2007; Rosa and Dawson, 2006). Third, factors related to the social construction of gender and stereotypes which surround it: the traditional gender roles which assign to woman more household chores (Etezkowitz *et al.*, 2000; Ledin *et al.*, 2007), the conflict between family life and work (Shaw and Cassell, 2007), gender profiles which present women as having a greater aversion to risk, a lower level of interest in money and financial transactions, or different attitudes to competition (Niederle and Vesterlund, 2005; Stephan and El-Ganainy, 2007).

Such studies provide new insights into the participation of academic women in spin-off creation, however, results are sometimes conflicting and do not aid a more systematic understanding of specific factors which encourage or inhibit involvement. In addition, the impression in the female entrepreneurship literature, that their access to human and financial resources is restricted, is challenged in the context of academia: we are dealing with highly

trained, capable women who exhibit high impact publication patterns (Thursby and Thursby, 2005), whose quality and impact of research is the same as if not better than that of male scientists (Whittington and Smith-Doerr, 2005) and they have equal access to university support. The question, thus, remains as to which factors explain the involvement of academic women in commercialisation through venture creation.

Adopting the lens of institutional theory, this study seeks to offer a more holistic understanding of the engagement and participation of academic women in scientific commercialisation through spin-off formation. Building upon previous studies from the fields of institutional theory and women's entrepreneurship, we identified three institutional levels which can affect the venture formation decision of academic women: the macro level, which relates, principally, to the gender roles and responsibilities which society assigns to women and which affect all women entrepreneurs equally; the meso level, which includes all the formal and informal institutional factors which are related to universities as a narrower framework within which venture creation activities are carried out; and, finally, the individual level, which seeks to capture aspects which can configure individual agency, such as motivation, human, social and financial capital. In adopting this framework we seek to identify the factors which affect academic women's decisions to become involved in venture creation at these varying levels of analysis and explore interactions between them.

The main contributions of this research are threefold. First, we focus on academic women's specific contexts which provide a deeper understanding of the unique factors which determine their participation in venture creation activity. Second, we adopt a multilevel approach (individual, meso and macro environment) and identify the factors which are included in each category, which offers a more complete view of the commercialisation activities of female academics. Last, we analyse how the interactions between levels have led to circumstances favourable to the decision to become an entrepreneur and explore the implications which they might have for specific university policies.

This paper is structured as follows. First, we outline the theoretical background related to institutional theory and female academic entrepreneurs. Second, we present the research design and methods of data collection employed in the study. In the final section, we discuss the results and outline their theoretical and practical implications.

THEORETICAL BACKGROUND: INSTITUTIONAL THEORY AND ACADEMIC WOMEN ENTREPRENEURS

Institutional theory suggests that individual behaviour is framed within established structures of meaning, comprising a web of socially-constructed, taken-for-granted prescriptions of appropriate conduct, named 'institutions' (Scott, 2001; Greenwood and Suddaby, 2006). Institutions are "constraints that shape human interaction" (North, 1990, p. 3), comprising symbolic elements, social activities and material resources which create legal, moral and cultural boundaries (Scott, 2001). Institutions offer a means for explaining social conformity and also reduce uncertainty by creating a stable structure for human interaction (Delbridge and Edwards, 2007). Institutions can be classified as both formal (laws, political and economic rules) and informal (such as culture of a given society, values, norms of behaviour and conventions). Adopting the framework for women entrepreneurs of Brush *et al.* (2009), we identify two institutional levels which surround and mediate a female academic's entrepreneurial actions: the macro and meso environments. Next, we review evidence from the literature on academic entrepreneurship and female entrepreneurship for each level of analysis identified (macro, meso and individual), highlighting factors associated with each.

The macro environment is defined at the national level as the policies and social, cultural and institutional arrangements (Brush *et al.*, 2009). It encompasses the macro

structures which frame gender roles and responsibilities within society (Kantor, 2002), which in turn shape not only how women perceive entrepreneurial opportunities, but also how the rest of society perceives female entrepreneurs. Bruni *et al.* (2004) suggest that a principal barrier for female entrepreneurs is the role with which women are widely identified within society. Within almost all cultures women are attributed domestic and family responsibilities. Household composition, gendered power relations and inequalities within the household account for differences in the entrepreneurial activity of men and women (Aldrich and Cliff, 2003; Brush *et al.*, 2009). Motherhood is still a choice which imposes penalties on women's professional career aspirations as a result of a lack of adequate professional and social support for bringing up children. For many it brings to a halt their progress within their professional career which from the very beginning has involved overcoming additional obstacles (Forster, 2000), as women, and specifically women entrepreneurs, have to work harder to convince people that they are as competent as their male counterparts (Brush, 1998; Bates, 2002). In addition, stereotyped professional patterns lead women to choose particular careers which fit with their socially-constructed roles and responsibilities (Blau *et al.*, 2002).

According to Lituchy *et al.* (2003), women participate in society differently and assume different roles. They are usually responsible for the home and children as well as for their professional development as employees or owners of their own businesses. If women are to succeed in managing effectively such diverse areas, they must demonstrate particular skills and achieve an appropriate work-life balance, for which they also require the support of their families and closest friends: for female entrepreneurs these are necessary elements for the success of their firms (Lituchy *et al.*, 2003). Research on female academics has demonstrated that whilst women have made real advances over the last 20 years, they usually have greater levels of domestic responsibilities than men, even although this results in slower professional progress or, at worst, an end to their academic careers (Forster, 2000). Thus, women academics still experience the conflict identified more than a decade ago associated with reconciling family life and professional work (Rosa and Dawson 2006; Shaw and Cassell, 2007; Whittington and Smith-Doerr, 2005).

Focusing on the second institutional level, the meso environment is the closer academic context within which women are embedded. This intermediate level, between the individual and the macro environment, includes university structures, policies and norms, and also embraces the professional and social networks or formal academic associations in which women participate.

Previous studies regarding these factors assign an important role to the structural elements of the academic environment which are viewed as inhibiting women's academic entrepreneurial activities. Whilst the proportion of female academics has increased markedly, they continue to occupy academic positions which are less visible. According to the *She Figures 2009 Report* "women represent only 44% of grade C academic staff, 36% of grade B academic staff and 18% of grade A academic staff" (European Commission, 2009, p. 9), and whilst data from 2012 show the general advancement of women between 2002-12 marked differences are still apparent in most countries (European Commission, 2012). Rosa and Dawson (2006) conducted an exploratory study with a sample of 20 spin-offs in the United Kingdom (UK) in which they identified that a key factor influencing the lower level of participation by women in founding spin-off ventures is their lower representation in more senior positions. Findings suggested that having a more senior academic job and leading research teams provide the best access to the commercial and institutional networks and financial resources required to establish a spin-off, roles typically occupied by men.

In terms of social capital and the development of entrepreneurial networks, some, but not all studies have revealed gender differences in the formation and management of

networks, as well as in their content and use (Aldrich, 1989; Olm *et al.*, 1988). Forster (2000) suggests that a lack of appropriate mentors and the greater institutional power which men tend to possess are some of the most important factors which hinder the progress of women within academia. Stephan and El-Ganainy (2007) suggest that the lower presence of academic women in university entrepreneurial activities in the area of biomedical sciences could result from the fact that women have fewer social networks related to scientific committees and fewer contacts with risk capital firms. The fact remains that there are very few women in scientific academies (Noordenbos, 2002), partly as a result of closed social networks whose membership comprises men, and these women rarely found companies. Firms offering risk capital and related services tend to be directed by men, resulting in women's work receiving less attention and being under-valued. Morley (1994) and Rhodes (1994) are amongst those who identify other challenges faced by female academics with academia. Women are excluded from key groups and clubs (Martin 2001), are often required to adopt a masculine approach in order to secure promotion, and find themselves stereotyped in certain types of roles.

With regard to our final level of analysis, the individual level, previous work on entrepreneurship amongst female academics has identified several factors which can have an impact upon their decision to establish a spin-off: their personal and professional motivations, human capital (including training and prior experience) and social capital (related to their personal and professional social networks).

In exploring the motivations which female academics have for creating spin-offs, researchers including Cunningham and Lischeron (1991) and Birley (1989) have revealed that, generally, there appear to be no differences between the motivations of men and women towards undertaking entrepreneurial tasks, processes in which they engage when establishing businesses, or in the way in which they structure their ventures. Most research shows that the basic motivations are a desire for work satisfaction, personal achievement and greater levels of independence and autonomy. Rosa and Dawson (2006) find no significant differences in the satisfaction which men and women experience when founding their spin-off firms nor in how difficult they perceive such a process to be, even although women tend to find it more stressful and difficult to combine their multiple responsibilities and obligations. Academic women are found, however, to exhibit greater aversion to risk and a lower level of interest in money and financial transactions, possess different attitudes towards competition (Niederle and Vesterlund, 2005), demonstrate a lower inclination towards selling scientific achievements and to seeking opportunities (Babcock and Laschever, 2003), and are inclined to focus on the types of research which offer fewer opportunities for commercial exploitation.

Regarding the impact of academic women's human capital on their decisions to establish spin-off ventures, research highlights that women's confidence in establishing new ventures may be conditioned by their lack of experience in business, administration and management, despite them possessing a high degree of scientific training (Rosa and Dawson, 2006). In addition, academic entrepreneurs who possess less experience often encounter structural gaps between their commercial and scientific research networks which have a negative impact upon their ability to recognise opportunities (Mosey and Wright, 2008). In addition, while, traditionally, women have benefited from less exposure to commercial activity, the quality and impact of commercial studies by women is equally good, if not better, than those of male scientists. Allen *et al.* (2007) confirm this finding in their analysis of human capital as a factor influencing the number of patents developed by a university. Nevertheless, in their study of 11 American universities with high levels of research and a long tradition of technology transfer to the private sector, Thursby and Thursby (2005) show that women are less likely to discover inventions than men, despite the fact that there are no

significant differences in publication patterns. They also show that, whilst levels of disclosure activity amongst women are approaching those of men, significant differences remain.

Finally, human and social capitals play a key role in influencing the recognition of opportunities and the valuing and exploitation of commercially-useful knowledge generated by universities. In their study of a group of academics who were involved in the creation of technology-based firms in the UK, Mosey and Wright (2008) identified that those entrepreneurs who possessed prior experience as owners of businesses had larger social networks and were more effective in developing network connections with experienced managers and potential investors.

METHODOLOGY

Research design

This review of literature focused upon female academic entrepreneurship indicates that we are dealing with a complex modern phenomenon, which has boundaries which are not clearly defined. Further, it is a research domain which is still far from achieving a level of maturity and it, therefore, warrants further attention. This context means that inductive a multiple-case design is an appropriate method of analysis (Yin, 2003) in order to help generate a deeper understanding of which are the important factors influencing the engagement of female academics in the establishment of spin-offs/start-ups. The use of a multiple-case design, applying replication logic, permits each case to be considered separately and for comparisons to be drawn between them (Yin, 2003; Brown and Eisenhardt, 1997). Thus, the individual case studies represent a comprehensive study within which convergent evidence is sought regarding facts and conclusions (Yin, 2003). One benefit is the findings' higher level of validity and chance to reflect upon their context.

This study adopted as its level of analysis the university level and the female academic entrepreneur constituted the unit of analysis. Here academic female entrepreneurs were defined as professors or researchers at a university who are involved in the creation and development of a university spin-off venture. A university spin-off is defined here as a venture created by at least one professor or researcher around a core innovation/research result, initially developed at the university (Vohora *et al.*, 2004).. Some institutions differentiate between spin-offs and start-ups: typically, a spin-off exploits university-generated intellectual property and the university has an ownership stake in the new venture, whereas there is no university IP or on-going involvement in a start-up. Other universities do not differentiate between the forms, classifying both as start-ups.

This approach, exploring both individual and institutional dimensions, differs from that employed in previous studies of academic entrepreneurship. It offers the potential to develop a more holistic perspective regarding the phenomenon of female academic entrepreneurship, and provide new insights as a result of this multi-level analysis.

Case selection

The research involved a detailed field study of the engagement of female academic entrepreneurs in the founding of university spin-offs in two case institutions, the University of Edinburgh in the UK and the University of Granada in Spain. The study also focused on the related institutional conditions prevailing within the two universities. Both institutions were selected for study according to the criteria of literal replication, so similar results were predicted (Yin, 2003).

From the macro-level perspective both Spain and Scotland offer environments in which socio-economic conditions are similar. In Spanish society the position of women is similar to that in Scotland, so there are no marked socio-political differences which might

generate different outcomes. Women are seen as having primary responsibility for caring for the home and family in both Spain and the UK, so similar stereotypes apply. A greater level of flexibility in the use and management of time, which facilitate balancing professional and domestic responsibilities, is sometimes seen as a benefit which derives from a career as a university academic.

Moving on to consider meso-level factors, both universities have long histories as each was founded nearly 500 years ago and has a strong tradition and high reputation for research and academic excellence: each is ranked amongst its country's top ten universities. Within each institution staff employment rights are similar and individual staff promotion is influenced significantly by research quality, where traditional metrics include research income generated and publications in leading journals rather than measures such as engagement in technology transfer.

Both Universities have similar structures to support the commercialisation of knowledge-related activities. At the University of Edinburgh, Edinburgh Research and Innovation Ltd (ERI) is responsible for supporting the institution's research activities and managing all aspects of knowledge/technology transfer and commercialisation. It achieves this through the provision of support and services in the following areas: research support and development, intellectual property management, technology licensing, company formation and incubation, science and technology PARKS and expertise/facilities.

In the case of the University of Granada, its Office for the Transfer of Research Results (OTRI) has the responsibility for promoting, stimulating and disseminating to the public knowledge-based outputs generated by the University's research groups. The activities which it performs are similar to those undertaken by ERI. The most marked difference is that the University of Granada has neither a pre-incubator nor an incubator of its own: all activities related to firm creation are undertaken in collaboration with a regional government agency which supports firm formation within its own Business Innovation Centre (BIC), which functions as an incubator for technology-based firms.

Historical data collected from both institutions indicate that the University of Edinburgh has better infrastructure and higher levels of technical and human resources to help support its activities than the University of Granada, in addition to a track record of targeted commercialisation activity spanning more than 40 years. Data related to the number of patents, contracts for licenses, and spin-offs/start-ups created reflect higher levels of activity at the University of Edinburgh (Table 1).

Table 1: Summary of key commercialisation results of Universities of Granada and Edinburgh

	University of Granada	University of Edinburgh
Disclosures*+	90 (last 5 calendar years)	580 (last 5 academic years)
Patents (filed)*+	86 (last 5 calendar years)	323 (last 5 academic years)
License agreements+	21 (last 5 calendar years)	200 (last 5 academic years)
Spin-out/start-up companies-total	56	154
Spin-offs/start-ups involving female academic or research staff	2	2

Source: University of Edinburgh and Granada websites and interviews with TTO officers. * Information for 5 years to 2008.
+ Calendar year=January to December, academic year=September to August.

Data collection

In-depth, face-to-face, semi-structured interviews were used to collect data from all the academic female entrepreneurs, directors of the university technology transfer offices,

managers of the business incubators and others individuals who develop and manage systems/initiatives to support entrepreneurial academics. These interviews were conducted between July, 2009 and April, 2010. Interviews represent a highly effective and efficient way to gather rich empirical data, particularly when the phenomenon which is of interest is episodic and infrequent, as is the case with female academic entrepreneurship. The use of different informants helped to limit bias and enabled diverse perspectives regarding the phenomenon to be gathered (Eisenhardt and Graebner, 2007). Adopting the approach of Eisenhardt (1989), background data were gathered for both universities which included information prepared by each university and that published in the media and on websites.

During the first phase of the research, those in charge of firm creation at each university were asked for a list of firms which they defined as spin-offs or start-ups founded by female academics or research staff, acting alone or in teams. Then, background information about these companies and their founders was collected from their websites. This information was then checked with staff in charge of commercialisation and technology transfer activities at the two universities. The information collated enabled us to determine the different types of links between the female founders and the universities, as well as the sorts of activity developed (Table 2).

Table 2: Summary of the academic women and spin-off company characteristics from the Universities of Edinburgh and Granada

	Entrepreneur 1 (Edinburgh)	Entrepreneur 2 (Edinburgh)	Entrepreneur 3 (Granada)	Entrepreneur 4 (Granada)
<i>Age</i>	40-49	30-39	50-59	20-29
<i>Academic background</i>	PhD Zoology Senior Research Fellow	PhD Artificial Intelligence Fellowship	PhD Pharmacy	PhD Business & Administration Fellowship
<i>Current academic position at University</i>	None	None	Reader	Lecturer
<i>Start-up year</i>	2004	2006	2007	2009
<i>Main activity of company</i>	Disease and pest control	Artificial Intelligence	Biotechnology	Social consultancy
<i>Nos of initial founders (gender profile)</i>	1	1	3 (1 woman and 2 men)	4 (2 women and 2 men)
<i>CEO</i>	Yes	Yes	No	No

A number of interviews were conducted with individuals responsible for different aspects of knowledge commercialisation and company creation at the two universities and associated organisations. A total of four people were interviewed at the University of Edinburgh: the Director of Company Formation and Incubation, the Director of Launch.ed, together with the Director and Manager of the EPIS (Edinburgh pre-incubator) programme. At the University of Granada the Director of OTRI and the person responsible for the area of business creation were interviewed. Given the collaborative agreement between the University of Granada and the BIC, the Director and Managers of the BIC were interviewed.

RESEARCH FINDINGS

Multilevel factors

Following the theoretical framework described above, we analysed the factors which affect academic women's involvement in spin-off creation with respect to the three different levels: the macro-institutional level, the meso-institutional level and the individual level. A summary of the data relating to the distinct levels is presented in Tables 3, 4 and 5.

Table 3: Summary of findings for macro-level factors

Macro-level factors	Entrepreneur 1	Entrepreneur 2	Entrepreneur 3	Entrepreneur 4
<i>Suitability of professional career chosen</i>	Would prefer to have an academic career.	Likes being entrepreneur.	The academic career is more suitable.	Does not make specific point on issue.
<i>Scientific field to which entrepreneur belongs</i>	It's a male-dominated area.	It's a male-dominated area.	It's a male-dominated area.	Equilibrium between women and men.
<i>Reconciliation of professional and personal lives</i>	Does not provide details on her situation.	Being an entrepreneur results in a great deal of self-sacrifice.	Academic careers provide more ways for reconciling them.	Academic careers provide more ways for reconciling them.
<i>Distribution of household tasks</i>	Single. No details on her situation.	Married. Receives a lot of support from her husband.	Married. No details on situation: discourse indicates assumed traditional female roles.	Married. Receives support from husband.
<i>Motherhood</i>	Does not have children.	Has two young children.	Has three teenage children.	Does not have children.

Interaction between levels

On the whole, the previous findings show that the four academic women who decided to become involved in spin-off creation face different inhibiting and enhancing factors from the macro and meso levels, while at the individual level, all academic women benefit from an encouraging environment in which to become an entrepreneur. Moreover, the interactions between the three levels led to a set of circumstances favourable to the decision to become an entrepreneur.

The macro level influences the individual level in the roles assumed by women in the domestic environment and that of family care. Even although the assumption of domestic responsibilities is an issue that appears directly only in some of the interviews, these women's situations are insightful for understanding the role of these factors. Of the four women that were interviewed one is unmarried, two of them count on the support of their husband in domestic and entrepreneurial activities and the last one does not provide details about her situation, but does talk about the traditional roles assigned by society to women.

As for motherhood, its direct effect was only present in one of the four situations because two of the entrepreneurs have no children and the children of the other are teenagers. Entrepreneur 2, who has to combine motherhood with business activity, emphasises several difficulties such as giving up her maternity leave and making additional efforts to keep her pregnancy hidden in order not to affect the efficient operation of her new venture. She also highlights the fact that women in her situation need to have additional resources at their disposal to invest in bringing up children and that she depends upon her husband's support.

On the other hand, when the sector of activity of the spin-off is male-dominated, women entrepreneurs are perceived differently from their male counterparts. There seems to be a perception that these women are unique and outstanding for having created and managed new ventures in spite of all difficulties and challenges. In other words, they are outstanding for having managed to find their own place in a "man's world". Nevertheless, these perceptions (indicated by TTO officers from both universities) only reinforce the idea that the gender stereotypes which surround the construction of the successful entrepreneurial feminine identity reflect women as multitasking (responsible for both household and professional tasks), well-organised and professional.

Table 4: Summary of findings for meso-level factors

Meso-level factors	Entrepreneur 1	Entrepreneur 2	Entrepreneur 3	Entrepreneur 4
<i>Support programmes and resources</i>	Was in pre-incubator, following EPIS programme, included mentoring, financial and consultancy support to set up firm. Firm was located on campus and received support via ERI and EPIS (access to loan, advice and social support).	Firm located in incubator and receives support of ERI (financial, consultancy and social support).	Firm located in incubator (BIC) of regional government, but usually works at University. Firm received financial support from university for setting up (legal and website expenses).	Nothing. She works at University. Firm received financial support from university to start up (website expenses).
<i>Policies on equity participation</i>	No equity participation of University in company. No restriction on equity participation of founders.	No equity participation of University in company. No restriction on equity participation of founders.	No equity participation of University in company. University restricts equity participation of founders.	No equity participation of the University in the company. The University restricts the equity participation of founders.
<i>Rewards or recognition</i>	Does not make a specific point on this issue.	Does not make a specific point on this issue.	Nothing.	Nothing.
<i>Gender programmes/policies</i>	None	None	Only in some applications for grants.	Only in some applications for grants.
<i>Industry and financial network from university</i>	Through academic experience is involved in business networks. Due to agreements between University and other institutions (government and companies) has applied for grants and financial resources.	Through academic experience is involved in business networks. Due to agreements between University and other institutions (government and companies) has applied for grants and financial resources.	Through academic experience is involved in business networks. Due to agreements between University and other institutions (government and companies) has applied for grants and financial resources.	Nothing.

The factors corresponding to the meso level also influence the individual ones in several ways. In the case of the female entrepreneur who decides to create a venture because she has no possibility of furthering her academic career (Entrepreneur 1), the meso-institutional level is a factor which strongly encourages her to create the firm. In fact, this entrepreneur appreciates all the support that she has received from the various programmes in which she took part in the university. Entrepreneur 2, who has been commercially-driven from the very beginning, also seems to benefit from the university's policies and programmes. It is for this reason that she decides to create her business within the university environment.

Entrepreneurs 3 and 4 are involved in spin-offs at the same time as they maintain a contractual relationship with the university. They see this experience as complementary to their academic activities: both are part of a formation team so the spin-off is a group initiative, and they are only marginally involved in the management of the venture. Their participation in their spin-offs is driven by personal and specific circumstances: in the case of Entrepreneur 3 it was her husband who took the initiative together with an external entrepreneur, whilst for Entrepreneur 4 she came in to contact with an entrepreneurial group. The meso level does not appear to provide incentives for these women to be involved in spin-off creation. Combining teaching activities with spin-off creation and management requires a significant effort that is not assessed or recognised within the criteria for academic promotion: incentives to engage in commercialisation activities are scarce within the academic environment as promotion criteria remain closely linked to research publications in leading journals and teaching activities. Universities offer an environment conducive for reconciling professional and family lives: for

those who are more commercialisation-oriented, a university position offers better schedules and greater flexibility compared with a job role in the commercial sector.

In addition to other inhibitors which women share in common with male faculty and academic researchers in general, women lack entrepreneurial role models within the academic environment. Thus,, the university environment fails to provide the adequate stimulus to makes start-up/spin-off creation an attractive pathway compared with an academic career. Rather, it seems to offer the perfect context to reconcile traditional gender roles and responsibilities with a professional career. Its influence appears to be quite negative for the majority of academic women who have a stable university position.

Table 5: Summary of findings for individual-level factors

Individual-level factors	Entrepreneur 1	Entrepreneur 2	Entrepreneur 3	Entrepreneur 4
<i>Start decision</i>	Push. Had to leave academic job and use academic knowledge and previous experience to set up company. Creating company is an employment option that allows her to continue doing what she knows.	Pull. Recognised an entrepreneurial opportunity when working in a financial company. Changed to academic pathway and focused on setting up company to exploit opportunity.	Push. Works together with husband and joined him in company. Participation in company does not interfere with academic career.	Push. Motivated by existence of an entrepreneurial team to take part in creation of business. Participation in company does not interfere with academic career.
<i>Motivations</i>	Independence and self control in work and life. Satisfaction of seeing more tangible results of work.	Money. Need for achievement in a man's world. Research dissemination.	Possibility to obtain more resources for research. Research dissemination.	Learning by doing and gaining experience. Satisfaction of seeing more tangible results of work.
<i>Human capital (previous experience)</i>	Obtained experience by applying research knowledge in consultancy services (freelancer) as well as company director of university spin-off.	Obtained commercial and technical experience by working in family business and previous jobs (included a financial company).	No business experience, but has undertaken several consultancy contracts with firms through OTRI.	No business experience, but had an active role in students and social associations.
<i>Role models</i>	Does not make a specific point on this issue.	Father mentioned as a very creative and entrepreneurial person.	Mentioned advice of mother about choice of professional career to accommodate work and family. Husband is her professional reference.	None.
<i>Personal social networks</i>	Has a business angel that has given financial support.	Husband provides emotional and financial support.	Shares personal networks of husband. Takes advantage of external entrepreneur's networks.	Husband supports in emotional and financial ways. Takes advantage of other entrepreneurs' networks.

Moving to the purely individual level, we observe that all the entrepreneurs draw upon important social and human assets when establishing their venture. For example, one of the major difficulties which entrepreneurial academics face when setting up their firm is their lack of business experience and training. In two cases, the entrepreneurs have business experience and training, whilst in the third and fourth the entrepreneurial team benefits from having an external entrepreneur from the commercial environment who handles these responsibilities. When the women are involved in a relationship as a couple, in the cases

analysed, the partner provides support for the entrepreneurial activities by sharing domestic responsibilities, offering financial support or directly taking part in the spin-off.

Analysing the macro and meso levels, and their interactions, the decision to create a spin-off depends mainly on the way the entrepreneurs, at their individual level, fight with the pressures (be they positive or negative) exerted by the different institutional levels (Table 6).

Table 6: Individual level configurations under the macro and meso-institutional levels factors

		MACRO LEVEL	
		Enhancing Factors	Inhibiting Factors
MESO LEVEL	Enhancing Factors	Entrepreneur 2: Permanent Entrepreneur <ul style="list-style-type: none"> • Push factors motivation. • Favourable settings. • High involvement. • The firm is a means of living. 	Entrepreneur 1: Vocational Entrepreneur <ul style="list-style-type: none"> • Pull factors motivation. • Favourable settings. • High involvement. • The firm is a means to exploit expertise.
	Inhibiting Factors	Entrepreneur 4: Uncertain Entrepreneur <ul style="list-style-type: none"> • Push factors motivation. • Favourable settings. • Low involvement. • Job insecurity. 	Entrepreneur 3: Incidental Entrepreneur <ul style="list-style-type: none"> • Push factors motivation. • Favourable settings. • Low involvement. • Job security.

Entrepreneur 1 is pushed towards the decision to create of a spin-off, because she is unable to continue her academic career, and specifically by the business experience gained within another spin-off. In this case, the macro level does not affect her and the meso level favours her decision.

Entrepreneur 2 is the only one who actively seeks to create a spin-off. Although the meso level influences her positively, the macro level exerts a strong negative pressure on her decision to become an entrepreneur. She manages to face this challenge thanks to strong motivation, solid business experience and her husband's support.

For Entrepreneurs 3 and 4, the decision to create a spin-off has been conditioned by push factors. Given their contractual relationship with the university, they are subject to a negative pressure from the meso level, as explained above, but the macro level does not affect Entrepreneur 4 (no children) negatively. The husband and business partner (the same person) of Entrepreneur 3 push her to become involved in the spin-off and she finds ways to use this engagement to complement her academic work (e.g. obtaining grants for research). Given that this entrepreneur suffers negative pressure from both the macro and meso levels, without the active participation of her husband she would probably never have set up a venture.

Finally, in the case of Entrepreneur 4, the pressure of the meso-institutional level is stronger than for Entrepreneur 3 because she does not have a permanent job at the University. It is uncertain how likely she is to be involved with the venture in longer-term as it does not help her to strengthen her academic position within the university as the current promotions systems does not recognise this experience and because the firm is not an active source of new knowledge or resources.

In conclusion, in the cases analysed, the main factors identified at both macro and meso levels affect academic women's decisions to create new ventures. Only when there were not inhibiting factors or those were minimised at the individual level, did women become entrepreneurs.

DISCUSSION

This study explores the phenomenon of women's entrepreneurship in the academic context and how institutional and individual factors influence their decision to set up a spin-off. Based on previous studies from the fields of institutional theory and women's entrepreneurship, we identified three institutional levels which can affect academic women's decisions to create spin-offs: the macro level which relates mainly to the gender roles and responsibilities which society assigns to women and which affect all women entrepreneurs equally; the meso level which includes all the formal and informal institutional factors related to universities as a narrower context within which venture creation activities are undertaken; and, finally, the individual level which seeks to capture all the aspects which can configure individual agency, such as motivation, human, social and financial capital.

The results suggest that, together with the analysis of the different levels, their cumulative effect and the interactions between them represent important explanatory factors regarding the decision to create a venture to commercialise university generated know-how. The individual level provides support to the academics to counteract the negative effects of the macro and meso levels, otherwise, the probability of being involved in venture creation would have been much lower. In fact, three of the four entrepreneurs did not actively set out to create a spin-off, nor initially consider it an attractive option, either personally or professionally.

So, from the point of view of institutional theory, generally, the macro factors appear negatively to shape the entrepreneurial activity of academic women, while the meso factors seem to have a positive influence for only a certain group of female academics: those who do not have a stable, secure, contractual relationship with the university. Current university politics related to spin-off creation appears to support mainly those researchers who have to end their contractual relationship with the university. They offer material, financial and consultancy support that appears to be adequate for these staff who, once they are no longer working for the university, want to continue doing the same type of work and exploit the findings of their research. Nevertheless, the interviews with the personnel responsible for commercialisation and company creation within both universities do not reflect a specific focus of the university towards inculcating an entrepreneurial spirit and awareness amongst this particular group of researchers: the support programmes of both universities are the same for all academics. On the other hand, where the female academics have stable jobs within the university, these current policies seem to act to inhibit their entrepreneurial initiatives.

The case of the pull-oriented entrepreneur is an atypical one. From the perspective of institutional theory, it is a representative situation for human agency (Scott, 2001). The entrepreneur is subjected to the pressure of different institutional factors, her actions are embedded into the current social norms regarding the role of women in society, yet she is able to envision and impose an alternative future: she is aware of the alternative and willing to embark on this journey and assume the consequences of doing so. On one hand she uses the current institutional frameworks and, on the other, she deals with the negative pressures they impose on her, in order to achieve her objectives. Future studies should explore these cases of individual agency in spite of their behaviour being embedded and shaped by current, conflicting norms.

The results of this research show that the study of the individual level, based on the characteristics of academic women, does not of itself explain the entrepreneurial process in universities. A consideration of the institutional perspective provides a more comprehensive theoretical framework for the specific analysis of this type of entrepreneur. In this sense, this work corroborates the suggestion of Brush *et al.* (2009) and uses two levels of analysis for the institutional factors. The contribution of the proposed model is that it considers the effect of

the interaction between these two levels and the individual, and shows the way in which the accumulation of pressures from the different levels acts as a brake on the creation of university spin-offs by female academics.

One of the main contributions of this research resides in revealing the interactions between the different institutional levels and the implication they might have for specific policies. The results show the decisive role of the meso level as a counterpoint to the possible negative effects produced by the macro level. Consequently, the keys to reducing these negative forces and cushioning the negative effects of the macro level are to be found within the academic environment itself. The current university policies for encouraging the creation of spin-offs are orientated towards the search for investors, the creation of company incubators and the provision of advice on the search for commercial applications of patents. Given that among those responsible for universities' commercialisation policies there is little or no awareness of the restrictions imposed by the macro level, academic women can find themselves marginalised from the entrepreneurial process. If universities are seeking to create wealth through the commercialisation of knowledge, they should not forget the knowledge which is created by women academics and, moreover they should recognise the diversity in the contexts of these women and consequently the diversity of their needs as exploiters. Those responsible in universities should take steps to adapt their policies to these needs in order to maximise value of this knowledge and capitalise on its exploitation.

Future research will be orientated towards identifying more female academic entrepreneurs at other institutions in order to generate further evidence to add to these findings. This research will explore what policy measures might be adopted to enhance levels of spin-outs in general and, more specifically, the numbers of women pursuing that career pathway, either as full-time entrepreneurs or as academic entrepreneurs whose research is firmly grounded in commercial reality.

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