

The Individual Environment Nexus: Impact of Promotion Focus and the Environment on Academic Scientists' Entrepreneurial Intentions

Maw-Der Foo, Mirjam Knockaert, Elsa T Chan, and Truls Erikson

Abstract—Using a sample of academic scientists, we show that promotion focus interacts with the work and family environments to predict academic scientists' entrepreneurial intentions. Concretely, we find that the relationship between promotion focus and entrepreneurial intentions is particularly strong when scientists' parents have owned a business and when they work in laboratories with more industry-financed research. As such, our study complements prior research into entrepreneurial intentions in academia, which has to a large extent focused on individual characteristics as determinants of such intentions. We highlight the vital role of the environment in encouraging academic entrepreneurship. Without a supportive environment, high promotion focus individuals are unlikely to become entrepreneurs. Our study has implications for the entrepreneurship literature, in particular academic entrepreneurship, and we call for more research on the individual–environment nexus.

Index Terms—Academic scientists, entrepreneurial intentions, individual–environment nexus, promotion focus.

I. INTRODUCTION

OVER the past decade, there has been a substantial increase in academic entrepreneurial activities in universities [1]–[3]. Whereas this evolution has led some researchers to suggest that the university and basic research are under threat, others have labeled this entrepreneurial university as the engine of the knowledge economy [4]. Though, traditionally, entrepreneurial activities at universities were particularly connected to research and senior faculty members, these activities have evolved and can just as well be executed by students, young faculty members, and postdocs [5]. Research that has looked at factors that facilitate the commercialization of university-based research has found that the success of commercializing university-based research is mixed [6]. Even when pressures to commercialize [7] and the number of university patents have increased, university technology has not consistently yielded significant returns

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to the universities [8]. One reason is that scientific knowledge developed in an academic context is often too general to be applied in industry [9]. Moreover, there is inherent tension between academic and commercial demands [10], [11]. Specifically, studies [12] and [13] point to the incentives and barriers between public and private knowledge, and conflicts related to intellectual property rights and industry administration, as hindrances for academic entrepreneurship and university–industry collaboration in general (see [5] for a review).

Despite the limited success of commercializing university technologies, entrepreneurship activities in universities have continued to flourish, especially among students, and other non-tenure track faculty. As such, some researchers have started to emphasize that to study the impact of entrepreneurship in academia, we should move away from the narrowly defined definition of commercializing university technology to include involvement in any kind of entrepreneurial activities [5]. Furthermore, it is warranted to include entrepreneurial intentions [14]–[16], and even the dissemination of knowledge and promotion of economic activity to the community [3], [4], [17].

Responding to this emphasis, our paper focuses on understanding entrepreneurial intentions in academia. As such, in line with several studies [14]–[16], we follow the broad definition of academic entrepreneurship, which goes beyond spin-off establishment to include any type of entrepreneurial intent of, among others, younger, nontenured researchers (we label this group as academic scientists in this paper). While tenured professors often have less uncertainty related to their future career path, untenured researchers are often unsure about their future career path. As such, it is likely for untenured researchers to engage in publishing research results (the publish-or-perish culture), which should strengthen their chances of pursuing an academic career, while also considering other activities, such as entrepreneurial activities, which may offer alternative career paths outside of academia, or help them develop skills and capabilities relevant outside of academia.

We study the entrepreneurial intentions of this group of academic scientists because such intentions are considered the single best predictor of entrepreneurial behaviors [18], [19] and intentions have been widely studied as outcome variable in diverse contexts [20], [21]. Further, studying entrepreneurial intentions in academia is important from a practical perspective. In particular, Huyghe and Knockaert [22] pointed to the appointment of technology transfer officers to bridge the inherent tension between academic and commercial demands. Importantly, as they argue, these officers are timeconstraint and may benefit from

focusing their attention toward those academic scientists having entrepreneurial intentions.

Because of its importance, understanding the factors that foster entrepreneurship and entrepreneurial intentions in academia is a core research agenda [23], [24]. This body of work has found that individual factors such as personal networks, role models, self-efficacy, and the types of research conducted all predict academic entrepreneurial intentions [25], [26]. A limitation of these studies is that they fail to acknowledge the individual–environment nexus. This is a notable limitation because the extent to which individual attributes matter depends on the situation that people are in [27]. As the trait activation theory emphasizes [28], whether individual factors matter depends a lot on the environment. If the environment does not activate a particular trait, those traits are not likely to be manifested. Hence, to fully understand how individual factors matter, the environment should be the starting point. Yet despite the major role of environmental factors and incentives in stimulating entrepreneurial activities in universities [13], some people are more likely to embark on the entrepreneurial journey than others. Again, consistent with the trait activation theory, the point we are making in this paper is that environment factors are important as it is the environment that activates a person’s trait. Hence, the environment should be studied in conjunction with individual factors to better predict entrepreneurial intentions [29]–[31].

Indeed, research has implied that scientists’ characteristics and the work situation are important determinants of the emergence or growth of academic entrepreneurial activities (e.g., [32] and [33]), yet how the individual and environment interact and exert their effects in this entrepreneurial process remains to be investigated. We contribute to the academic-entrepreneurial intentions literature by studying the nexus of individual and environment conditions and how this predicts the entrepreneurial intentions of academic scientists. We also respond to the call by Siegel and Wright [5] for research on entrepreneurial activities in universities to use more microconcepts to understand this phenomena.

For individual characteristics, we study promotion focus. Promotion focus is an approach toward achievement-oriented situations where individuals concentrate on achieving goals and idealized selves [34]. Brockner *et al.* [35] theorized that promotion focus can help explain entrepreneurial success. Because of this assertion, studies on promotion focus in entrepreneurship (e.g., [36]) have generally looked at its impact on firm success. Few studies have linked this focus to entrepreneurial intentions. We believe that studying the effect of promotion focus on entrepreneurial intentions is necessary because such intentions affect whether or not academic scientists embark on the entrepreneurial journey in the first place.

We reason that high promotion focused individuals are especially keen to be entrepreneurs in environments that support entrepreneurship. That is, there is a multiplicative effect of promotion focus and the environment. We base our reasoning on the fact that individuals high in promotion focus relentlessly pursue their goals [34]; if they desire to be entrepreneurs, they pursue this goal aggressively. Through the interplay of what a person is suited for and complementary preferences, entrepreneurial

activities flourish [37]. In the next section, we hypothesize that promotion focus together with work and family environments predict entrepreneurial intentions of academic scientists.

II. THEORY DEVELOPMENT

In this section, we explain how this individual–environment nexus predicts entrepreneurial intentions [29], [30], [38] among academic scientists. Specifically, while academic entrepreneurship in a broad sense has been defined as “any activity that occurs beyond the traditional roles of teaching and research, is innovative, carries an element of risk, and leads (in)directly to financial rewards for the individual academic or his/her institution” [14], we take into consideration that not all entrepreneurial endeavors academics undertake are necessarily connected to their research activities or will result in financial rewards for the institution. As such, this study focuses on entrepreneurial intentions in academia, which incorporate the intentions to engage in spin-offs companies, but are definitely not limited to it.

In this paper, we take as the starting point the major role of the environment in stimulating academic activities in universities [13]. We emphasize that an environment conducive to entrepreneurial activities activates the academic scientists’ promotion focus toward entrepreneurial intentions and we draw on the trait activation theory to ground our hypotheses. The trait activation theory [28] is a person–situation interaction model. The theory suggests that when there are situational cues that are relevant to the trait, the trait is activated and individuals will engage in behaviors according to what the trait predicts (see also [27]). When the family environment or the work environment is favorable and motivating for entrepreneurial activities, the scientists’ promotion focus will be activated, and this interaction predicts higher entrepreneurial intentions.

We study the individual factor of promotion focus and the environment factor of family/work environment (particularly, when the academic scientists’ parent(s) have owned a business, or when there is more industry-financed research) and how the individual–environment nexus predicts entrepreneurial intentions. Individuals high in promotion focus use approach and proactive means to attain desired endstates or idealized selves [34]. A person’s level of promotion focus is influenced by his or her subjective history of success [39]. This is based on McClelland and Atkinson’s classic theory of achievement motivation. As McClelland [40] and Atkinson [41] asserted, over time a new achievement task elicits feelings associated with past task engagements. Subsequently, individuals with subjective histories of success tend to feel pride when given new tasks, leading to the development of a promotion focus. In the following sections, we theorize that promotion focus coupled with environments supporting such activities will enhance entrepreneurial intentions.

We decided to study promotion focus because this factor has been found to predict outcomes in uncertain and entrepreneurial environments. For example, entrepreneurs’ promotion focus was found to be positively related to venture performance in dynamic and uncertain entrepreneurial environments [42]. Studies have found that entrepreneurs with a high promotion focus are willing to take more risks. Entrepreneurs with a high promotion

focus strive for their goals as their ideals and aspirations and do not concentrate on the losses [43]. Burmeister-Lamp *et al.* [44] founded that these entrepreneurs spend more time on entrepreneurial tasks even when spending more time yields more risks. In the world of academic scientists, an academic job is typically more stable than an entrepreneurial job. Their intention to change the status quo and to engage in the dynamic process of entrepreneurship could largely depend on whether they are willing to approach uncertainty and take some risks.

There are a few studies that examine the link between promotion focus and entrepreneurial behaviors or success. First, Burmeister-Lamp *et al.* [44] suggested that regulatory focus can explain entrepreneurs' time allocation decisions. Entrepreneurs who have a high promotion focus spend more time working on entrepreneurial tasks when more hours lead to more risks. Entrepreneurs with a high prevention focus spend less time on these tasks. However, when more hours mean less risk, entrepreneurs with a high promotion focus spend less time on the tasks but those with a high prevention focus spend more time on the tasks. Further, Hmieleski and Baron [42] founded that promotion focus is positively related to venture performance in dynamic and uncertain entrepreneurial environments. In stable entrepreneurial environments, there is no relationship between promotion focus and venture performance. Finally, Tumasjan and Braun [43] founded that promotion focus is positively related to opportunity recognition and innovativeness of opportunities identified.

Despite the contributions of these studies, the environment has mostly been neglected. We believe that high promotion focused academic scientists will have higher entrepreneurial intentions in environments that are supportive to entrepreneurship. This assertion is consistent with the trait activation theory that individual factors matter mostly in environments that activate a person's trait. Specifically, we examine how the family and work environment could be especially relevant and could trigger the activation of entrepreneurs' promotion focus, which could predict entrepreneurial intentions.

We first hypothesize how the family environment—in particular whether parents owned businesses—together with promotion focus, predicts the entrepreneurial intentions of academic scientists. Second, beyond the family, work-related environmental factors could also influence entrepreneurial activities [45], [46]. In the context of universities, Henrekson and Rosenberg [47] observed that financial incentives for researchers and industry-financed research encourage science-based commercialization. Consistent with these observations, we investigate how promotion focus together with the extent to which the research laboratory engages in industry-financed research predicts entrepreneurial intentions.

A. Family Environment—Entrepreneurial Status of Parents

Individuals are more likely to start businesses when their parents have owned businesses [46], [48], [49]. Parents act as role models and those raised in entrepreneurial families tend to develop positive attitudes toward entrepreneurial activities [46], [49], [50]. Katz [51] proposed a psychosocial cognitive model to explain the relationship between being raised in entrepreneurial

families and entrepreneurial intentions. He suggested that when individuals are deciding which profession to go into, they use past experiences as the starting point. Moreover, individuals whose parents have started businesses are more likely to seek education, training opportunities, or join entrepreneurship clubs to develop skills that an entrepreneurial career requires. These activities further spur interest to be an entrepreneur and increase confidence to succeed in this career [48], [52].

We propose that higher levels of entrepreneurial intentions come about when a high promotion focused person comes from an entrepreneurial family. High promotion focused people tend to work toward their ideal selves [34]. While having been raised in a family of entrepreneurs can make people excited about starting their own businesses, promotion focus enhances the salience and vividness of this vision. In this way, promotion focus creates a link between positive attitudes toward entrepreneurship and the motivation to turn preferences into intentions. When a high promotion focused person does not come from an entrepreneurial family, he or she may lack the experience and memory of entrepreneurship and decide to pursue other activities instead. In cases of low promotion focus, a person who has positive attitudes toward entrepreneurship may question whether the trials, difficulties, and problems that entrepreneurs invariably encounter are worth the effort. It is important to note that the entrepreneurs' children may pursue entrepreneurial careers upon graduation. However, for those already in academic research career, if they have a parent who owns a business, this related entrepreneurial family environment will interact with promotion focus and predict their intention to engage in entrepreneurial activities in the future. Taking the joint effects of promotion focus and family background into consideration, we hypothesize that:

H1: When scientists' parent(s) have owned a business and the scientists have a high promotion focus, they will have higher entrepreneurial intentions.

In addition to the family, the work environment should also be considered as both family and work are two important spheres in a person's life experiences [46], [53]. In the following, we explain how the work environment of academic scientists together with promotion focus impacts entrepreneurial intentions.

B. Work Environment—Industry-Financed Research

It is widely recognized that building industry–science relations is difficult. A key issue is the inherent tension between academic and commercial demands [11], including differences in time horizon between academic and industry research [54]. Furthermore, the incentives between academia and industry differ. Academia encourages knowledge dissemination, whereas the commercial sector seeks ownership and tight control of intellectual property rights. Even with these tensions, there is government pressure for research institutions (since they use public funds) to commercialize [3]. And for funded research, there are greater pressures for the research to bring about economic and social benefits [4].

We reason that researchers working in laboratories that value commercialization are more likely to have entrepreneurial intentions. We draw on the attraction, selection, and retention

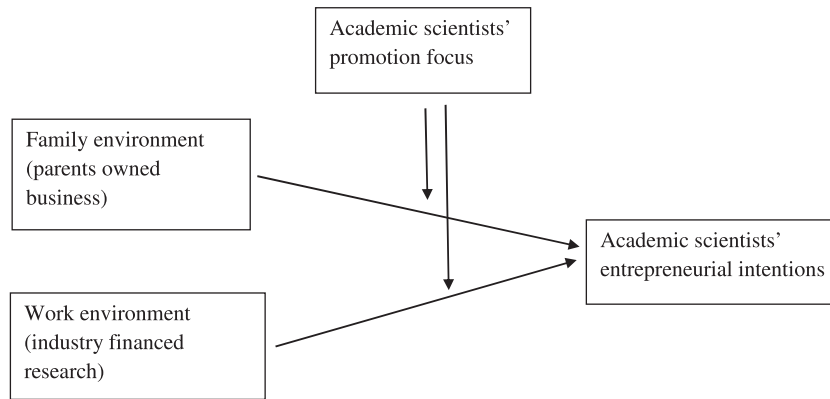


Fig. 1. Effects of family and work environments and promotion focus on academic scientists' entrepreneurial intentions.

theory [55] to explain this. Individuals are usually attracted to organizations whose norms are congruent to theirs. Similarly, organizations tend to hire people who share the organizations' norms [55]. After hiring, employees are subjected to formal and informal socialization activities reinforcing these norms [56]. If misalignment still occurs, employees often manage this discomfort by changing their values to fit the organization [27], [57]. Therefore, through attraction, selection [55], socialization [56], [58], and value change over time [57], employees tend to adopt norms consistent with their organizations. If all efforts to align values fail, a person is motivated to leave the organization [55].

Related to the aforementioned, we hypothesize that entrepreneurial intentions should be higher when a high promotion focused researcher works on industry-financed projects. Research laboratories doing industry-financed projects are expected to transfer technologies for commercial purposes [47], [59]. Due to attraction, selection, and retention mechanisms, academic scientists working in laboratories that rely on industry-financed research should also be favorably predisposed to commercialization. High promotion focused academic scientists working in this environment should have positive attitudes toward entrepreneurship, and subsequently, report higher entrepreneurial intentions. Given the high uncertainty of the entrepreneurial environment, low promotion focused individuals, even in the presence of an environment favoring entrepreneurship, could avoid such activities. Hence, we hypothesize that:

H2: When high promotion focused scientists work in laboratories with more industry-financed research, they will have higher entrepreneurial intentions.

Our conceptual framework is presented in Fig. 1.

III. METHODS

A. Participants and Procedures

Our sample comprised 201 doctoral and postdoctoral researchers from a university in Norway. Data were collected in February 2010, using an online questionnaire. Specifically, we study entrepreneurial intentions of a group of junior, untenured researchers, i.e., pre- and postdocs as opposed to tenured faculty for a number of reasons. First, while the role of professors for

entrepreneurial activities in academia has been widely studied (e.g., [60]), we know little about this group of junior academic scientists, who however produce a substantial share of university knowledge and frequently interact with industry [61]. Second, as opposed to tenured professors, academic scientists often face significant uncertainty related to their future career path [62]. Academic scientists are thus more likely than tenured professors to expand their capabilities following this uncertainty, such as keeping their options open on multiple career trajectories inside and outside of academia. Furthermore, as Ambos and colleagues [54] indicate, these new-generation researchers are the ones who are most extensively faced with the changing institutional environment in which research excellence and valorization are promoted simultaneously.

The data collection phase was preceded by a pilot phase during November 2009–January 2010, during which respondents were also requested to provide comments on the questionnaire, allowing refinement of the instrument. The survey population consisted of 924 doctoral and postdoctoral researchers in the Faculty of Mathematics and Natural Sciences. They received a request to complete the online questionnaire through email, sent by the central administration, and signed by the research team and the vicedean. The first mailing resulted in a response of 170 researchers, and was followed by a second email request one week later, resulting in 112 additional responses. From the total of 282 responses, 81 were eliminated due to missing data, resulting in 201 full questionnaires—an effective response rate of 22%. *T*-tests showed no significant differences between early and late respondents in age, type of academic scientist (doctoral or postdoctoral researcher), and time employed at the university. The average age of the respondents was 32 (s.d. 6.15) and 37.2% were women; respondents had been employed by the university for an average of 3.24 years (s.d. 3.19).

B. Measures

1) *Entrepreneurial Intentions*: Entrepreneurial intentions were measured using Linan and Chen's [63] three-item scale. Participants responded on a seven-point scale from 1 (unlikely) to 7 (likely) to the following questions: "you will pursue a career as an entrepreneur," "you will pursue a career as employed in an

organization” (reverse coded), and “you will start a business” (Cronbach’s Alpha = 0.71, mean = 2.80, s.d. = 1.26).

2) *Promotion Focus*: This variable was measured using the scale developed by Lockwood *et al.* [64]. Nine questions were used to measure promotion focus on a scale of 1 (disagree to a large extent) to 9 (agree to a large extent). Sample items include: “I frequently imagine how I will achieve my hopes and aspirations,” “I often think about the person I would ideally like to be in the future,” “I typically focus on the success I hope to achieve in the future,” and “I often think about how I will achieve my academic success.” Scale reliability measured by Cronbach’s Alpha was 0.82. The average promotion focus was 6.39 with an s.d. of 1.22.

3) *Parents-Owned Business*: Following the wording used in the Global Entrepreneurship Monitor surveys, participants were asked the question: “has either of your parents ever owned a business?” The responses were coded as 1 (28% of the sample) if either of the parents had owned a business and 0 otherwise.

4) *Industry-Financed Research*: Participants answered the following question “What percentage of your research time was dedicated to research financed by industry over the previous year?” The average percentage of industry-financed research time was 16.83% (s.d. = 32.87).

5) *Control Variables*: We controlled for individual and work factors that are linked to entrepreneurial activities. Specifically, as age is likely to impact career decisions, we controlled for the respondent’s age [48]. Further, as men typically foster more entrepreneurial intentions than women, we control for gender [49]. Then, in line with the findings by Farmer *et al.* [50], we control for startup experience and entrepreneurial identity aspiration. While the first variable is a dummy variable, measuring whether the academic scientists had been involved in the founding of a start-up company before, the latter assesses to which extent becoming an entrepreneur is important to the individual’s self-concept.

IV. RESULTS

Before testing the hypotheses, we tested for discriminant validity of the constructs. We conducted two tests to verify the distinctiveness of the latent variables used in this research. The first test was to compare the variance shared by each construct and its measures with the variance shared by both constructs [65]. This indicates that the variance captured by two constructs needs to be larger than the squared correlation between them. Average variance extracted for each construct exceeded the squared correlation between it and any other construct. Second, using confirmatory factor analysis, we compared the unconstrained model with the constrained model in which the correlation between the two constructs was fixed at one. A significant difference in chi-square values for the constrained and unconstrained models indicates the distinctiveness of the two constructs. All the differences were significant ($p < 0.01$), providing strong evidence of discriminant validity.

Common method bias is unlikely to affect the hypotheses that are based on interaction effects [66], although such bias can impact the main effects. Therefore, we conducted a test to check

for common method bias. Using confirmatory factor analysis, we controlled for a single unmeasured latent method construct following the unmeasured latent method construct technique outlined by Richardson *et al.* [67] and Faccieu *et al.* [68]. Specifically, we used confirmatory factor analysis to test alternative measurement models. Model 1 was a null measurement model (i.e., no factors underlie the data). Model 2 posited that a single method factor explained the data. Model 3 was the measurement model used in this study in which the constructs of interest or “traits” (particularly: promotion focus and entrepreneurial identity aspiration) were positioned to underlie the data. Model 4 posited that the data could be accounted for by the traits in Model 3 plus a single uncorrelated method factor.

To check for common method bias, we first compared Model 1 and Model 2. Model 1 provided a significantly better fit to the data than Model 2 ($\chi^2 = 1002.6$, $df = 13$, $p < 0.001$). This indicated that the observed variance in the independent and dependent constructs did not result from method only. In the second comparison of Model 3 and Model 4, Model 4 did not significantly fit better than Model 3 ($\chi^2 = 133.7$, $df = 14$, $p > 0.05$). This indicated that common method bias was unlikely to exist. Subsequently, we partitioned the variation accounted by Model 4 into trait and method components. Specifically, for each item, the square of the trait factor loading and of the method factor loading indicate the amount of variance due to trait and the method factors, respectively. The average amount of variance due to the trait model was 39%, compared to 12% for the method factor. It is generally accepted that the common method bias present in the data is not sufficient to bias results if the proportion of variance attributed to method is smaller than 25% [69], [70], which was the case for our data. Consequently, there was no evidence to suggest the results would be affected by common method bias.

Table I shows the descriptive statistics and zero-order correlations of the variables. For the control variables, entrepreneurial intentions correlated significantly with gender ($r = -0.36$) (where 1 = male, and 2 = female), previous startup attempts or experiences ($r = 0.33$), and entrepreneurial identity aspirations ($r = 0.72$). Promotion focus was not linked to entrepreneurial intentions ($r = 0.08$) suggesting that having a promotion focus by itself does not imply that an individual pursues entrepreneurial activities.

We performed hierarchical regressions to test our hypotheses. Table II shows the regression results. In Model 1, only the control variables were included. We then added the independent variables in Model 2 and the interaction terms in Model 3. The highest variance inflation factor for the models was 1.80 suggesting that multicollinearity was not a problem in the regressions.

Results in Model 1 of Table II show that the control variables as a whole explained 58% in the variation of entrepreneurial intentions ($F = 49.76$, $p < 0.001$; $R^2 = 0.58$). In particular, entrepreneurial intentions was positively related to gender ($\beta = -0.372$, $p < 0.01$), indicating that men have stronger entrepreneurial intentions than women, previous startup experience ($\beta = 0.576$, $p < 0.01$), and entrepreneurial identity aspiration ($\beta = 0.535$, $p < 0.001$). In Model 2, we added the

TABLE I
MEANS, STANDARD DEVIATIONS, AND CORRELATIONS OF THE STUDY VARIABLES

	<i>M</i>	<i>SD</i>	1	2	3	4	5	6	7	8
1 Entrepreneurial intentions	2.80	1.26	(0.71)							
2 Age	32.15	6.15	0.07	–						
3 Gender	1.37	0.48	-0.36	0.02	–					
4 Previous startup experience	0.15	0.36	0.33	0.20	-0.12	–				
5 Entrepreneurial identity aspirations	2.34	1.46	0.72	-0.05	-0.29	0.38	(0.96)			
6 Promotion focus	6.39	1.22	0.08	-0.20	0.11	0.12	0.19	(0.82)		
7 Parents owned business	0.28	0.45	0.13	0.06	-0.06	0.05	0.07	-0.08	–	
8 Industry-financed research	16.83	32.87	0.11	-0.01	0.00	0.08	0.21	0.04	-0.05	–

Note. $|r_s| \geq 0.13$ are significant at the 0.05 level (two-tailed); $|r_s| \geq 0.18$ are significant at the 0.01 level (two-tailed). Cronbach's Alpha on diagonals.

TABLE II
REGRESSION ANALYSES ON ENTREPRENEURIAL INTENTIONS

	Model 1			Model 2			Model 3		
<i>Control Variables</i>	<i>B</i>	<i>S.E.</i>	<i>t</i>	<i>B</i>	<i>S.E.</i>	<i>t</i>	<i>B</i>	<i>S.E.</i>	<i>t</i>
Age	-0.017 †	0.010	-1.77	-0.018 †	0.010	-1.71	-0.019 †	0.010	-1.95
Gender	-0.372 **	0.107	-3.47	-0.291 *	0.117	-2.48	-0.265 *	0.115	-2.30
Previous startup experience	0.576 **	0.210	2.74	0.561 *	0.229	2.45	0.548 *	0.222	2.47
Entrepreneurial identity aspirations	0.536 ***	0.054	9.86	0.553 ***	0.056	9.80	0.565 ***	0.056	10.11
<i>Independent variables</i>									
Promotion focus				-0.065	0.056	-1.16	-0.144 +	0.074	-1.94
Parents owned business				0.108	0.138	0.79	0.137	0.138	1.00
Industry-financed research				-0.000	0.002	-0.05	-0.000	0.002	-0.17
<i>Interaction terms</i>									
Promotion X parents owned business							0.257 *	0.105	2.46
Promotion × industry-financed research							0.003 †	0.002	1.71
R^2	0.576			0.581			0.599		
ΔR^2				0.006			0.017 *		
ANOVA <i>F</i>	49.76			27.70			23.63		

Note. Independent variables were meancentered. $N = 201$ * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$, † $p < 0.10$.

main effects for promotion focus, parents-owned business and industry-financed research. The coefficients of these variables were not significant, suggesting there were no main effects of these variables.

Model 3 shows that the interaction terms as a group significantly increased the amount of variance explained in entrepreneurial intentions ($R^2 = 0.60$, ΔR^2 over Model 2 = 0.02, $p < 0.01$). The interaction terms were significant at 0.05 and 0.10 levels—levels that are acceptable for interaction effects balancing Type I and Type II errors [71]. We graphed these significant interaction effects in Figs. 2 and 3 with high and low defined as +1 s.d. and -1 s.d., respectively. Supporting Hypothesis 1, promotion focus \times parents-owned business-related positively to entrepreneurial intentions ($\beta = 0.257$, $p < 0.01$). Fig. 2 shows that having a parent who owned a business had higher entrepreneurial intentions among individuals high in promotion focus but lower entrepreneurial intentions among individuals low in promotion focus. The interaction of promotion focus with industry-financed research was significant ($\beta = 0.003$, $p < 0.10$). The results support Hypothesis 2 that industry-financed research should predict entrepreneurial intentions for individuals high in promotion focus rather than for their low promotion focused counterparts. As Fig. 3 shows, at low levels of industry-financed research, individuals low in promotion focus

had higher entrepreneurial intentions, while at high levels of industry-financed research, the entrepreneurial intentions converged for both groups.

V. DISCUSSION

We study entrepreneurship in academia among a group of academic scientists and show that entrepreneurial intentions of academic scientists come about when individuals with the suitable psychological characteristics are put in environments favoring such activities. Our study responds to the call to study entrepreneurship in academia broadly, instead of limiting the study to commercialization of university technology [14]–[16]. Our findings show that individual promotion focus interacts with the work and family environments to determine academic scientists' entrepreneurial intentions.

A. Theoretical Implications

Our study has theoretical implications in at least two domains. First, it contributes to the entrepreneurship field by emphasizing and introducing the individual–environment nexus using a trait-activation approach. Second, our study also contributes to the literature on entrepreneurial intentions, and particularly, the literature on entrepreneurial intentions in academia. Indeed, it

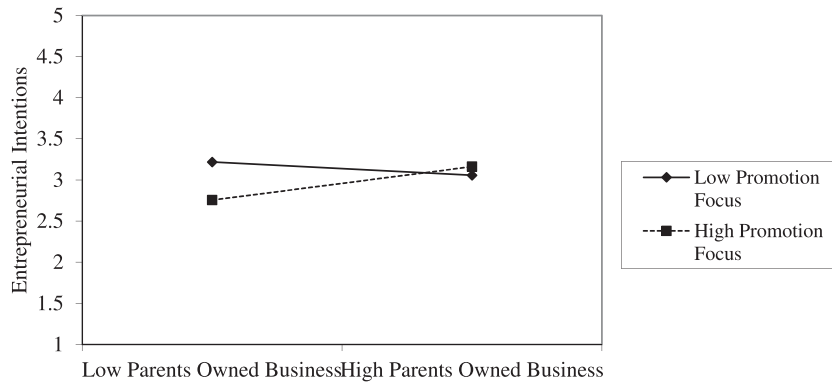


Fig. 2. Interaction effect of promotion focus and parents owned business predicting entrepreneurial intentions.

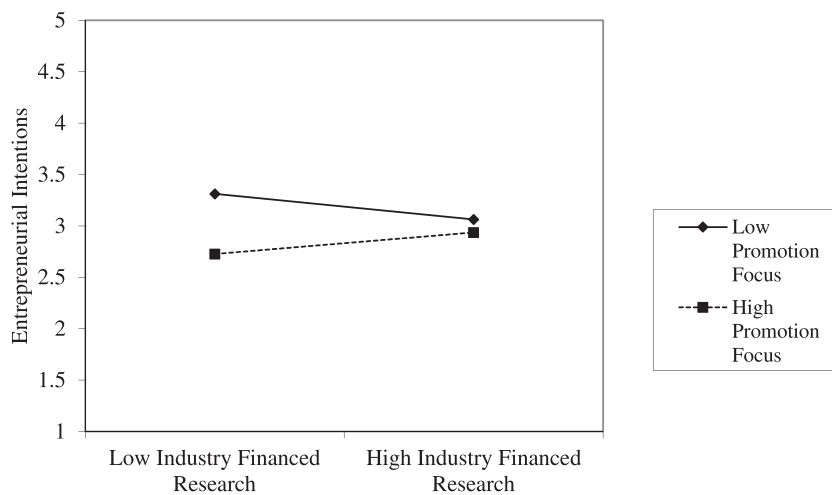


Fig. 3. Interaction effect of promotion focus and industry-financed research predicting entrepreneurial intentions.

complements studies in this domain, which have to a large extent focused on the individual level. For instance, researchers have found that entrepreneurial self-efficacy, type of research, number of years the academic scientist stayed at the institute [72], attitudes and perceived control [73], and social identity [25] were linked to entrepreneurial intentions in academia. Further, while researchers have recently started to acknowledge the importance of environmental factors for different aspects of the entrepreneurial process at universities [31] and entrepreneurial intentions in academia particularly [22], to our knowledge, no studies have assessed the impact of the interrelationship between individual and contextual factors for such intentions.

Within this individual–environment nexus, we studied promotion focused academic scientists and how the individual–environment nexus was related to entrepreneurial intentions by these scientists. High promotion focused individuals are effective in uncertain environments, such as the environment faced by early stage entrepreneurs [42], [43]. However, as we show, promotion focus as an individual trait by itself does not predict entrepreneurial intentions. Instead, a person’s trait is activated only in some environments [27], [28]. The environment a person is in—family and work environments in this study—has strong influences on entrepreneurial intentions [47], [74]. Our findings

are consistent with the trait activation theory [28]. To our knowledge, this theory has mostly been neglected in entrepreneurship research studying the individual–environment nexus.

Academic scientists in our study are more likely to have higher entrepreneurial intentions when they are high in promotion focus and are in family environments that encourage entrepreneurship. Past studies have generally looked at direct family effects and failed to examine interaction effects. A contribution of our paper is to show that the parents’ entrepreneurial status on entrepreneurial intentions relationships can be strengthened among high promotion focused individuals.

As for the work environment and promotion focus relationship, that relationship is more complicated. As our findings revealed, industry-financed research is linked to lower entrepreneurial intentions among individuals low in promotion focus, but industry finance did not result in higher entrepreneurial intentions for individuals high in promotion focus. This may be explained by the situation that industry-financed research provides job security as continued employment sometimes depends on external funding. This situation is not unique to our sample as many engineering and science-oriented doctoral students are funded this way [75].

As such, our study points to the importance of incorporating individual and contextual factors in studies on entrepreneurship in general and entrepreneurial intentions specifically. While our findings point to the importance of studying the individual–environment nexus, they also give rise to a number of future research suggestions.

B. Limitations and Future Research

A limitation in our study is that we did not explore if it makes any difference whether one or both parents were entrepreneurs, but this could be relevant. For instance, if one parent is an entrepreneur and the other is a stay-at-home parent, employment preferences could reflect self-employment as people raised in such families may look upon the employed parent as the work model. Whether the business was inherited, or whether the parent started the business might also predict entrepreneurial intentions. Future studies can do a more fine-grained analysis of family backgrounds and how these backgrounds shape entrepreneurial desires.

It is important to note that in this study, we only looked at one form of self-regulation, that of promotion focus. Promotion focus emphasizes a proactive approach to attain one's goals. There is another form of self-regulation that emphasizes a more defensive approach to fulfill one's obligations—that of prevention focus. Promotion focus and prevention focus could both be effective under different circumstances. For example, Hmieleski and Baron [42] found that when the industry environment is stable, prevention focus is more effective. When the industry environment is dynamic, promotion focus is more effective. Hence, there could be two paths to encouraging entrepreneurial intentions. More studies are needed to examine when, and how prevention focus and promotion focus predict entrepreneurial success. Another suggestion is to create an environment where a person gets excited to become an entrepreneur. This is consistent with the literature on push and pull entrepreneurship. In the former, a person goes into entrepreneurship because s/he is dissatisfied with the current situation. In the latter, the person goes into entrepreneurship because s/he is excited about that. Perhaps, apathy is the worst thing for encouraging entrepreneurship.

In this study, for the university environment, we only studied industry-financed research. We studied this factor because researchers who work in laboratories with industry-funded research face pressures for their research to have economic and social benefits. It should be acknowledged that other important factors can increase entrepreneurial intentions. These include successful entrepreneurial activities in the university and coop learning experience [7], and the university culture or climate [22]. Studying these and other environmental factors in addition to industry-financed research could lead to a better understanding of how the environment, together with individual factors lead to entrepreneurial intentions. More research is also needed on how incentive systems interact with promotion focus to affect entrepreneurial intentions. Incentive systems in the university could potentially drive high promotion focused academics to have higher entrepreneurial intentions. Research has suggested that promotion focused individuals respond better to reaching goals and to attaining success [76], [77]. Messages

framed in such a way that emphasizes goal or success related benefits would activate the promotion focused preferences of high promotion focused individuals. More broadly, more research is needed on the role of institutions and the way public policies may influence entrepreneurial intentions by changing institutions. Regulative, normative, and cultural cognitive institutions influence, both directly and indirectly, the perceptions that individuals may have about the desirability and feasibility of entrepreneurship. Institutions can both constrain and enable self-employment and entrepreneurship [6], [8], [78].

C. Practical Implications

The study has practical implications for understanding and encouraging entrepreneurial intentions in academia in the areas of selection, education and training, and evaluation. Gaining more insights into the relationship between factors at the nexus of the individual and the environment is particularly interesting to practitioners such as technology transfer managers, university management and public policy makers. Indeed, while public policy has significantly invested in encouraging entrepreneurship within universities, for instance, by providing funding for the recruitment of technology transfer officers, resources are limited. As such, insights into which factors at the individual–environment nexus are most likely to be related to higher levels of entrepreneurial intentions are particularly relevant to these resource-constraint parties as it can help them in efficiently achieving their entrepreneurial goals.

Our research points to the important role that the environment plays in encouraging academic entrepreneurship. Without the correct incentives, structures, and programs, universities would not be able to encourage entrepreneurial activities. Under favorable circumstances, individuals high in promotion focus are especially interested in engaging in entrepreneurial activities. Therefore, research laboratories keen in commercializing technologies should create an environment that is favorable toward entrepreneurship, such as setting aside time for academic scientists to work on entrepreneurship activities, and through this environment activate the entrepreneurial desires of high promotion focused individuals.

Our study also has implications for the training, education, and evaluation of academic scientists and the organizational units they belong to. University management can encourage and incentivize research laboratory managers and department heads to engage in industry–science interactions, which can take different forms such as contract research, consultancy, or researcher mobility [3]. By promoting and giving visibility to those laboratories and departments that highly engage in industry–science interactions and by giving incentives for such activities, more departments may generate environments that promote entrepreneurial activities, which will be particularly inspiring for high promotion-oriented individuals.

VI. CONCLUSION

Drawing on the trait activation theory, we emphasize the critical role of the environment. Also consistent with the trait activation theory, under favorable work or family environments, promotion focus is a lever of entrepreneurial intentions. As our

study suggests, academic scientists who are high in promotion focus develop high intentions to engage in entrepreneurship when the family and work environments are favorable toward commercialization activities. By examining the person–environment nexus, we gain a better understanding of how the inner individual characteristics and the outer work and family environments operate together to influence entrepreneurial intentions. We encourage future research to study the effects of the individual–environment nexus from a trait-activation approach. Overall, our research responds to the call by Siegel and Wright [5] to broaden the concept of entrepreneurship activities in universities to go beyond commercializing technology. We also respond to their call to include microconcepts to better understand this phenomena.

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