

Schumpeter's entrepreneur – A rare case

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Abstract In this paper we investigate Schumpeter's description of an entrepreneur as an actor challenging conventional wisdom to overcome social resistance and skepticism along psychological, sociological and economic dimensions. We analyze motivational and contextual predictors of intentions to become an entrepreneur within a framework based on the theory of planned behavior, social identity theory, and self-categorization theory. Relying on survey data of scientists, our analysis finds that, among those scientists who indicate entrepreneurial intentions, a rather low, but non-negligible share shows entrepreneurial intentions based on a Schumpeterian attitude – i.e., *acting against all odds* – whereas the rest of the potential entrepreneurs seem to choose an entrepreneurial career in order to comply with the expectations of their social environment – they seem to *follow the crowd*. By additionally taking into account the Five-Factor model of personality, our finding that entrepreneurial intentions are determined by cognitive and social factors rather than by basic psychological traits leaves room for policy intervention to foster technology entrepreneurship.

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1 Introduction

According to Schumpeter (1934), the entrepreneur is a quite special actor willing to break through traditional structures and to challenge the accepted way of doing things. The Schumpeter-type entrepreneur is individualistic, self-directed, has an inner drive to innovate, and, as stated by Leskinen (2011), seeks autonomy and “independence from other people” in order to be “in control of one’s own destiny” (p. 5). Schumpeter (1934) further argued that the fascination of entrepreneurship is especially strong for people “who have no other chance of achieving social distinction” (p. 93). In recent psychological research, this psychological and sociological characterization of an entrepreneur finds some support. For example, in their seminal study on entrepreneurial career intentions, Krueger et al. (2000) argue that the prototypical entrepreneur is an “iconoclastic individualist” with a strong “tendency toward inner-directedness” (p. 424).

Extending Schumpeter’s early characterization of entrepreneurs, a rich literature developed going beyond sheer economic determinants of entrepreneurial activities and taking on board psychological as well as sociological dimensions (e.g., Schmitt-Rodermund 2004, 2007; Tajfel and Turner 1979; Turner et al. 1987; Hogg and Abrams 1988; Rauch and Frese 2007). On this background, in this paper we investigate Schumpeter’s description of an entrepreneur along psychological, sociological and economic dimensions. We add to the existing literature by investigating whether (potential) entrepreneurs rather *follow the crowd* or whether they come close to Schumpeter’s entrepreneur as someone *acting against all odds* – and whether this is a rare case.

The consideration of psychological as well as sociological determinants of entrepreneurial activities opens up a policy oriented discussion which goes beyond considering sheer economic incentives. In addition, measures may be considered influencing mind-sets, competences and social context. According to Lundström and Stevenson (2006), such *entrepreneurship policies* should create an entrepreneurial climate that will be conducive to successful entrepreneurial activity. They also point out that entrepreneurship policy must focus on all phases of the individual entrepreneurial process, including the very early stages of the formation of entrepreneurial intentions. The inclusion of entrepreneurship in more general policy approaches such as *Smart Specialization* raise the issue on which level and in which direction appropriate policy measures should be designed. Questions have been raised whether for entrepreneurship policy it is sufficient to just work on the opportunity set of potential firm founders in the sense of mentoring, consulting and awareness building; or going beyond that, whether an effective policy design needs to address factors much more closely related to the individual’s social environment and on the individual level, taking account of the personality structure of would-be entrepreneurs. In relation to our findings, in our conclusion we also briefly refer to these related policy issues.

Our analysis uses data on a special group of potential entrepreneurs, namely, academic scientists who may be inclined to commercialize their research findings through founding an own firm. This choice can be justified on two grounds. First, academic entrepreneurship and the related concept of the *Entrepreneurial University* have gained importance and momentum during the last couple of decades (OECD 2003; see Perkmann et al. 2013; Rothaermel et al. 2007 for comprehensive literature reviews on this topic). Second, the focus on academic would-be entrepreneurs provides a rather clear and easily detectable population where the potential for innovative entrepreneurship (i.e., based on science-based business ideas) is particularly high. Out of this population we created a fairly representative sample of German scientists for our analysis. Certainly, academic entrepreneurs and the pool out of which they emerge are rather different from other types of entrepreneurs and their social realm, such as corporate or green field entrepreneurs. Most importantly, academics are employed in higher education institutions which provide a work environment that does not necessarily have any linkages to the business world. Whereas in earlier times scientists' active involvement in the commercialization of their academic research knowledge was met with consternation among academic peers, only recently has the scientific community experienced a significant change of view (Owen-Smith and Powell 2001). University faculties have come to accept and, in many institutions, to endorse the participation in entrepreneurial endeavors. As Etzkowitz (1998 stated, "The norms of science which traditionally condemn profit-making motives are beginning to change to allow for ... entrepreneurship". These non-negligible differences between academia and the business world will certainly play a role for our results and need to be taken up in the discussion of our results, especially when the policy dimensions are to be addressed.

Despite the considerable attention intentions-related research has received in the current entrepreneurship literature (e.g., Fayolle and Liñán 2014; Kautonen et al. 2015; Krueger 2009; Obschonka et al. 2012), to our knowledge we offer a first attempt to integrate basic psychological characteristics described by the Five-Factor model of personality (Costa and McCrae 1992; Barrick et al. 2003; Schmitt-Rodermund 2004, 2007; Zhao and Seibert 2006; Rauch and Frese 2007) as well as motivational and contextual predictors of entrepreneurial intentions proposed by Ajzen's (1991) theory of planned behavior (TPB), social identity theory (Tajfel and Turner 1979; Hogg and Abrams 1988), and self-categorization theory (Turner et al., 1987) into a framework explaining the individual scientist's intentions to become an entrepreneur. From the perspective of policymakers and representatives of support programs, the intention predictors highlighted by the TPB are amenable to change through interventions (Fayolle 2005), whereas with respect to the Five-Factor personality dimensions, the opportunities for policy intervention come to an end since those traits are considered as nature-given and gene-determined (e.g., Jang et al. 1996). Knowledge about determinants of scientists' entrepreneurial intentions may thus give hints as to what type of policy initiative and other university interventions would be instrumental in turning prospective scientist-entrepreneurs into actual business creators.

The paper is structured as follows. Section 2 introduces entrepreneurial intentions and emphasizes its importance for this study. We then set out our theoretical framework and related hypotheses in Section 3. This is followed in Section 4 by the presentation of our data and variables used. Section 5 contains the findings of our empirical analysis. Finally, in Section 6, we discuss our findings, conclude, and draw implications for potential policy interventions.

2 Theoretical framework and hypotheses

2.1 The role of entrepreneurial intentions

Entrepreneurship research acknowledges the intentionality of the entrepreneurial process (Bird 1988; Krueger and Carsrud 1993). Acting entrepreneurially is something that people choose or plan to do (Shaver and Scott 1991). Consistent with longitudinal findings (e.g., Lee et al. 2011), the most proximal and important predictor of the engagement in entrepreneurial behavior is seen in entrepreneurial intentions (Bird 1988). Simply put, these are cognitive representations of a person's readiness to engage in entrepreneurship. Entrepreneurial intentions signal how intensely one is prepared and how much effort one is planning to commit in order to carry out entrepreneurial behavior. Even if people may have significant potential, they will refrain from making the transition into entrepreneurship when they lack the intentions (Krueger et al. 2000). Accordingly, the study of entrepreneurial intentions represents a key approach for investigating the complex factors underlying an individual's transition to entrepreneurship (Krueger 2009).

Against this background, we adopt the intentions-based view to study psychological, sociological and economic dimensions of the Schumpeterian entrepreneur. We focus on an academic entrepreneurship context as a suitable arena for the study of entrepreneurial intentions due to the overarching presence of entrepreneurial potential here, namely, new research knowledge.

2.2 The theory of planned behavior (TPB)

The TPB offers a coherent, parsimonious, and highly-generalizable framework for understanding and predicting behavioral intentions of different kinds, which makes it a good choice when studying antecedents of behavioral intentions in the context of entrepreneurship (Krueger et al. 2000; Goethner et al. 2012; Kautonen et al. 2015). Given the general and basic nature of the TPB approach, we expected this framework to also apply in the specific domain of academic entrepreneurship with its special focus on scientists' active participation in the entrepreneurial exploitation of new research knowledge (Shane 2004). The core assumption of the theory of planned behavior (TPB; Ajzen 1991; Fishbein and Ajzen 2010) is that behavioral intentions are an additive function of three conceptually independent factors: attitudes, social norms, and perceived behavior control.

Attitudes reflect the individual's enduring evaluation – positive or negative – of engaging in a particular behavior. Psychological literature on attitude formation further advocates a distinction between two attitude components: affective attitudes, which refer to feelings or emotions, and cognitive attitudes, referring to beliefs, thoughts, or rational arguments (Crites et al. 1994). Existing literature suggests that academic scientists allocate their efforts and time toward entrepreneurship if they have a favorable appraisal of entrepreneurial activity (e.g., Gulbrandsen 2005; Owen-Smith and Powell 2001), and when they expect to gain reputation or other rewards (i.e., financial) as a likely consequence of commercializing their research (Göktepe-Hulten and Mahangaonkar 2010; Lam 2011), which hints at the relevance of affective and cognitive attitudes.

Social norms refer to perceived normative pressure from a specific reference group toward engaging or not engaging in a particular behavior (Ajzen 1991). Our study considers individual scientists' workplace peers as a salient reference group determining their entrepreneurial behavior. Previous research suggested that scientists feel pressure to become involved with the commercial exploitation of their research knowledge, and are thus more likely to do so, if they sense that their local peers look favorably on such activity (Rahm 1994). In addition, demonstration effects may play a role as scientists are more open to becoming entrepreneurs when colleagues in their research departments had been involved in entrepreneurship and when they perceived commercial technology transfer as a legitimate professional activity (Bercovitz and Feldman 2008; Stuart and Ding 2006). In line with this literature and following other TPB studies (e.g., Cialdini et al. 1990), we consider two sources of normative peer influences on intentions to become an entrepreneur. First, injunctive norms are concerned with scientists' perceptions as to whether workplace peers would approve of their engagement in innovative entrepreneurship. Second, descriptive norms reflect scientists' perception of their workplace peers actual engagement in entrepreneurial behavior.

Perceived behavioral control is closely related to Bandura's (1997) concept of self-efficacy and reflects the perceived ease or difficulty of performing a particular behavior successfully. The TPB would expect that scientists who do not perceive themselves to have control over entrepreneurial behavior and its outcome are unlikely to form strong entrepreneurial intentions, even if social norms and attitudes toward entrepreneurship are favorable. This is supported by entrepreneurship research that stressed the importance of self-efficacy as a mechanism for overcoming perceptions of the higher financial, technological, and legal uncertainties often associated with the commercialization of research knowledge via entrepreneurship (Markman et al. 2002; Obschonka et al. 2010).

In sum, we expect entrepreneurial intentions to be positively predicted by the TPB variables attitudes (affective and cognitive), social norms (injunctive and descriptive), and perceived behavioral control (*Hypothesis 1*).

2.3 Moderating effect of group identification within the TPB framework

In order to investigate more deeply the Schumpeterian entrepreneur, we integrate social identity, defined as scientists' group identification with their academic workplace peers, into the TPB framework. The link between social identity and the TPB has received considerable research attention (Fielding et al. 2008; Terry et al. 1999) and has recently been supported in an entrepreneurship context by, e.g., Obschonka et al. 2012 who showed that the strength of group identification can affect the relative strength of the TPB predictors.

According to social identity theory (Tajfel and Turner 1979; Hogg and Abrams 1988) and self-categorization theory (Turner et al., 1987), individuals have a tendency to identify with groups in their social environment (e.g., with workplace peers). If they do so, a particular social identity is salient that influences personal decision-making processes, such as the decision to become an entrepreneur. It is argued that those individuals with a salient social identity orient their behavioral choices in terms of group thinking and norms and less in terms of their own idiosyncratic attitudes and

beliefs (Terry et al. 1999; p. 229). Indeed, it is well documented that individuals who identify themselves as a member of a particular group, such as the group of workplace peers, are more inclined to behave according to the perceived norms of that group (Hogg and Abrams 1988). Thus, whereas the above discussed perceived social norms capture the direct effects of peers' normative pressure on intentions, an individual's group identification marks boundary conditions for these peer group effects, as it determines the individual's likelihood of following the group's norms (Terry et al. 1999).

Translated to the context we study, our expectation is that scientists' group identification with their academic workplace peers influences the cognitive processes that, according to the theory of planned behavior (TPB), underlie the formation of entrepreneurial intentions. In particular, we expect that group identification may function as a moderator of the relationship between entrepreneurial intentions and the perceived social norms, i.e. injunctive norms (*Hypothesis 2a*) and descriptive norms (*Hypothesis 2b*). When scientists strongly identify with their workplace peers, their intentions to engage in entrepreneurship should be significantly driven by the perceived social norms of the peer group. These potential entrepreneurs tend to engage in innovative entrepreneurship in order to conform to socially accepted behavior – hence they could be regarded as being less Schumpeterian and rather *following the crowd*. On the other hand, the peer group's social norms should be less important for the prediction of entrepreneurial intentions if scientists exhibit lower levels of group identification. This group of potential entrepreneurs would be characterized as “Schumpeterian deviants” who are less likely to follow the peer group's norms but to act *against all odds* instead.

2.4 Personality traits

To Schumpeter (2002, p. 417), the entrepreneur in his role as the creative destructor “... uses his personality and nothing but his personality”. Prior research provides a basis for theorizing the connection between specific personality traits and the likelihood to choose an entrepreneurial career via the Five-Factor model of personality (Barrick et al. 2003; Schmitt-Rodermund 2004, 2007; Zhao and Seibert 2006; Rauch and Frese 2007). According to this model, an individual's personality comprises five broad personality dimensions, i.e., conscientiousness, extraversion, agreeableness, openness, and neuroticism (the “Big Five”; Costa and McCrae 1992).

Conscientiousness is attributed to a socially assessed impulse control that facilitates goal- and task-oriented behavior. Typical traits of this factor are thinking before acting, delaying gratification, and planning, organizing, and prioritizing tasks (John and Srivastava 1999). Drawing on McClelland (1961), individuals who reveal a need for achievement tend to be attracted by work situations in which they have personal control over outcomes, face moderate risk of failure, and experience direct and timely feedback on their performance (Zhao et al. 2009). Hence high-need-for-achievement individuals are suggested to be attracted to entrepreneurship that is supposed to offer more of these conditions than traditional forms of employment. Other traits related to conscientiousness, such as work goal orientation and perseverance, tend also to be associated with entrepreneurial activities. Markman and Baron (2003) suggest that perseverance is called for by

entrepreneurial work, while others have emphasized the importance of motivation, persistence, and hard work (e.g., Chen et al. 1998; Baum and Locke 2004). Based on these arguments, we expect that entrepreneurial intentions are positively predicted by conscientiousness (*Hypothesis 3a*).

Extraversion is defined as "... an energetic approach toward the social and material world and includes traits such as sociability, activity, assertiveness, and positive emotionality" (John and Srivastava 1999). Extraverted individuals are gregarious, outgoing, warm, and friendly; they are energetic, active, assertive, and dominant in social situations; they experience more positive emotions and are optimistic; and they seek excitement and stimulation (Zhao et al. 2009). These traits have been shown to be associated with people's perceptions of entrepreneurs (e.g., Locke 2000; Costa et al. 1984). Compared to many traditional business occupations, running an own firm may appear to be more stimulating and exciting and thus more appealing to extraverts. This leads us to expect that entrepreneurial intentions are positively predicted by extraversion (*Hypothesis 3b*).

The Five-Factor trait agreeableness pictures a pro-social and communal tendency in direction of other people and contains qualities such as altruism, tender-mindedness, trust and modesty (John and Srivastava 1999). Individuals showing a high degree of agreeableness are characterized as trusting, altruistic, cooperative, modest, concerned for the needs of others and deferring to others in the face of conflict (Zhao et al. 2009). Contrariwise, individuals without agreeableness appear being manipulative, self-centered, suspicious, and ruthless. Individuals with high agreeableness are most likely to go for a career in social occupations and teaching, rather than business (Barrick et al. 2003). Entrepreneurship, however, involves establishing a for-profit enterprise that is built around the entrepreneur's own needs and interests (Singh and DeNoble 2003). Entrepreneur must fight hard, sometimes to the detriment of previous employers, partners, suppliers, and even one's own employees. Hence, given the low importance of altruistic behavior for entrepreneurial success and the high likelihood of guarded and even conflict ridden interpersonal relationships associated with entrepreneurship, we suggest highly agreeable people are unlikely to find the entrepreneurial role an attractive one. Accordingly, we expect that entrepreneurial intentions are negatively predicted by agreeableness (*Hypothesis 3c*).

A person's openness covers the broadness, deepness, genuineness, and complexity of her mental and experiential life (John and Srivastava 1999). It is a personality trait that describes an individual being intellectually curious, imaginative, and creative and seeking out new ideas and alternative values (Zhao et al. 2009). One of the defining characteristics of entrepreneurship is creativity and proclivity to bring about innovative change, as suggested by Schumpeter (1934). In this sense, entrepreneurs pursue their creative vision even in the face of overwhelming resistance from more conventional thinkers (e.g., Locke 2000). Hence, we expect that entrepreneurial intentions are positively predicted by openness (*Hypothesis 3d*).

Neuroticism renders the inclination to have negative emotions and to feel anxious, nervous, sad and tense (John and Srivastava 1999). In addition, neuroticism is connected to weaker psychological and physiological health (Lahey 2009). Contrariwise, individuals who are emotionally stable can be described as calm,

stable, even-tempered, and hardy (Zhao et al. 2009). The latter characteristics are just ascribed to entrepreneurs (Locke 2000). Individuals who show low emotional stability and hence high neuroticism tend to feel vulnerable to psychological stress and experience a range of negative emotions more frequently and intensely, all of which are detrimental for entrepreneurial activities. Therefore, we expect that entrepreneurial intentions are negatively predicted by neuroticism (*Hypothesis 3e*).

According to the theory of planned behavior (TPB), the Five-Factor personality traits, representing an individual's broad personal dispositions, should be seen as distal intention predictors, or so-called background factors, whereas attitudes, social norms, and perceived behavioral control refer to proximal intention predictors (Fishbein and Ajzen 2010). As such, background factors are proposed to affect intentions only indirectly via the proximal TPB variables. More specifically, the TPB states that behind attitudes, social norms, and perceived behavior control are salient beliefs and that these beliefs may be related to personality traits and other individual difference variables (Fishbein and Ajzen 2010). Given these arguments, we expect that the distal Five-Factor personality traits do not predict entrepreneurial intentions over and beyond the effect of the more proximal variables of the extended TPB framework (*Hypothesis 4*).

Drawing from the TPB and previous entrepreneurship research (Wang et al. 2015), we further expect that the Five-Factor personality traits are significantly related to the individual-level intention predictors (i.e., affective attitude, cognitive attitude, perceived behavioral control, group identification) (*Hypothesis 5a*), whereas no such relationship should exist with the context-level intention predictors (i.e., injunctive norm, descriptive norm) (*Hypothesis 5b*).

Figure 1 depicts all hypothesized relationships.

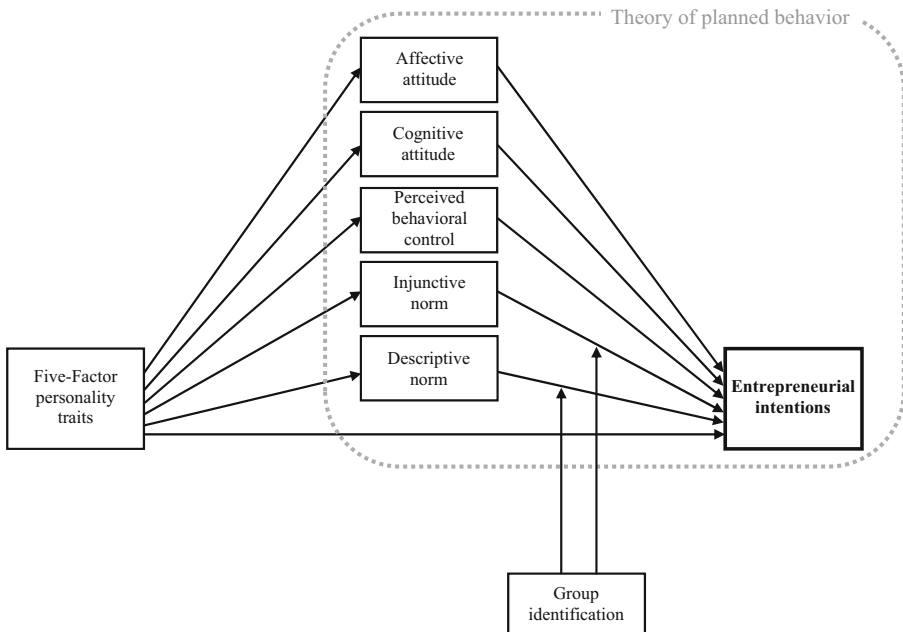


Fig. 1 Conceptual model for the prediction of entrepreneurial intentions

3 Research design

3.1 Sample and procedure

This study is part of the Thuringian Founder Study (“Thüringer Gründer Studie”), an interdisciplinary research project that examines the determinants of innovative entrepreneurship from the perspective of economics and psychology. The data for this study stem from a Web-based survey of scientists employed in German research institutions (universities, non-university research institutes such as Fraunhofer Institutes and Max Planck Institutes) to examine entrepreneurial motivations in a population where the potential for innovative entrepreneurship (i.e., based on science-based business ideas) is particularly high. In June 2008, data were collected from a survey sample of 565 scientists, drawn at random from the population of scientists working in research institutions in the German Federal State of Thuringia, Germany (for a detailed description of the sample selection and the data collection procedure see Goethner et al. 2012; Obschonka et al. 2012). Before conducting our analysis, we excluded 111 participants due to incomplete data. We also excluded 54 participants who reported that they did not conduct any research, as this study targeted scientists' intentions to commercialize their *own* research. The final sample consists of 400 scientists.

On average, participants were 38.8 years old ($SD=11.54$, range: 23–65) and male (72 %). Two-thirds worked in a university (65 %), 10 % worked in a university of applied sciences (“Fachhochschule”) and 25 % in non-university research institutions. Regarding their occupational status, 71 % of the participants worked as research associates, 18 % were professors or university lecturers, and 11 % reported another field of activity, for example, as technical assistant. More than half of the sample (56 %) described their type of engagement in research as applied science, and the remainder (44 %) as basic science. The largest group of participants worked in the field of natural sciences (49 %), whereas 33 % worked in engineering sciences and 18 % in economics, law, or social sciences. According to official statistics on scientists in Germany (Statistisches Bundesamt 2008), the survey sample is representative in terms of age, gender, and academic rank.

3.2 Measures

3.2.1 *Dependent variable: entrepreneurial intentions*

Ajzen and Fishbein (1980) distinguish between unconditional and conditional measures of behavioral intentions. Other than measures of unconditional intentions, conditional intentions measures consider potential barriers that could prevent individuals from intending to engage in a particular behavior. An unconditional measure of intentions to engage in entrepreneurial behavior would simply ask respondents to assess the likelihood that they will become an entrepreneur. In the context of our study, a potential barrier might be that scientists who consider their research not to possess any commercial potential might be distracted from answering such a question. To avoid this and to provide evidence on an unselected representative sample of scientists, we decided to adjust for the influence of the commercial orientation of scientists' research activity by focusing on their conditional entrepreneurial intentions. Adapting from Ajzen (2002),

conditional entrepreneurial intentions were measured with the item “If my research had economic potential, I would intend to participate in the founding of a firm to commercialize the former” (five-point Likert scale; 1 = no, 5 = yes). Note that one-item measures of intentions, as applied here, have been successfully employed in prior entrepreneurship studies (e.g., Krueger et al. 2000).

3.2.2 TPB variables and group identification

Cognitive attitude toward entrepreneurship was tapped applying an indirect, belief-based measurement (Ajzen and Fishbein 1980; Ajzen et al. 2004). First, scientists evaluated four potential outcomes of starting an own business on a bipolar scale ranging from -2 (“extremely negative”) to 2 (“extremely positive”). Potential outcomes of entrepreneurial behavior of scientists (i.e., higher personal income, conflict of interests with administrations, additional sources of funding for future research projects, increase in scientific reputation) were derived from the literature on academic entrepreneurship and university-industry technology transfer (e.g., Etzkowitz 1998; Owen-Smith and Powell 2001; O’Gorman et al. 2008) and from interviews with experts (e.g., university administrations, founders of academic spin-off firms). Second, scientists assessed the probability that these outcomes would occur if they would indeed found a firm (five-point Likert scale; 1 = not at all, 5 = definitely). To produce a belief-based estimate of cognitive attitude, belief strength and the corresponding evaluation regarding each potential outcome of academic entrepreneurship were multiplied and the resulting products summed up.

Respondents’ *affective attitude* toward academic entrepreneurship was measured with four five-point bipolar adjective scales (Ajzen 2002; “My personal attitude toward a participation in the founding of a firm to commercialize my own research is that this is...; Item 1: “uninteresting vs. interesting”; Item 2: “unattractive vs. attractive”; Item 3: “boring vs. exciting”; Item 4: “waste of time vs. worth investing as much time as possible”; $\alpha = .88$).

Injunctive norm was assessed with two items, each referring to academic workplace peers (Ajzen 2002) (“Most of my colleagues whose opinions matter to me...; Item 1: “... think I should participate in the development of a business idea to commercialize my research”; Item 2: “... would encourage my participation in the development of a business idea to commercialize my research”; five-point Likert scale; 1 = not at all correct, 5 = totally correct; $\alpha = .75$).

Descriptive norm was measured with two items (Conner and McMillan 1999) (Item 1: “How many of your colleagues have already participated in the founding of a firm to commercialize their research?”; Item 2: “How many of your supervisors (if applicable) have already participated in the founding of a firm to commercialize their research?”; five-point Likert scale; 1 = none, 5 = all; $\alpha = .60$).

Following Ajzen and Madden (1986), *perceived behavioral control* was assessed by three items (Item 1: “I believe I can meet the demands posed by a participation in the founding of a firm to commercialize my research”; Item 2: “I am convinced that I would find it generally easy to participate in the founding of a firm to commercialize my research”; Item 3: “If I wanted to participate in the founding of a firm to commercialize my research, I am confident that I

would succeed”; five-point Likert scale; 1 = not at all correct, 5 = totally correct; $\alpha = .83$).

Three items assessed respondents' *group identification* with their workplace peers (Terry and Hogg 1996) (Item 1: “Generally speaking, how much do you identify with your group of colleagues at the university / research institute?”; Item 2: “Personally, how strong is your sense of belonging to the group of your colleagues at the university / research institute?”; Item 3: “Do you share social bonds with your colleagues at the university / research institute?”; five-point Likert scale; 1 = not at all correct, 5 = totally correct; $\alpha = .78$).

3.2.3 Personality traits

We used a well-validated German 45-items questionnaire (Ostendorf 1990) to derive the Five-Factor personality factors (Costa and McCrae 1992). *Openness* (e.g., “conventional vs. inventive”), *conscientiousness* (e.g., “lazy vs. diligent”), *agreeableness* (e.g., “good-natured vs. cranky”), *extraversion* (e.g., “uncommunicative vs. talkative”), and *neuroticism* (e.g., “vulnerable vs. robust”) were measured by nine six-point bipolar items each, with Cronbach's α coefficients ranging between .60 and .83.

3.2.4 Control variables

Following earlier research on academic entrepreneurship (Landry et al. 2006; Murray and Graham 2007; Shane 2004), there are other potential influences on academic scientists' likelihood to become an entrepreneur. Taking this literature into consideration, we controlled our analysis for *gender* (0 = female, 1 = male), *age*, *occupational status* (1 = professor, 0 = other), *type of research* (0 = basic research, 1 = applied research), and *entrepreneurial experience* (0 = no, 1 = yes). We also controlled for scientists' field of specialization with a series of binary variables (0 = no, 1 = yes) for *engineering sciences*, *natural sciences*, and *social sciences*. The latter category was used as the reference category in the regression models.

Table 1 provides descriptive statistics of the above specified variables.

4 Results

4.1 Descriptive results

The correlations between all study variables are displayed in Table 2. Among the control variables, *gender*, *type of research*, *engineering sciences*, and *entrepreneurial experience* are associated with entrepreneurial intentions. Hence, scientists report stronger intentions when they are male, work in fields of applied research, are engaged in engineering science, or have already gained experience in previous entrepreneurial episodes. With respect to the psychological factors described in the theory of planned behavior (TPB), namely, attitudes (*affective* and *cognitive*), social norms (*injunctive* and *descriptive*), and *perceived behavioral control*, all variables correlate positively with

Table 1 Descriptive statistics

	Variables	Mean	S.D.	Min	Max
[1]	Entrepreneurial intentions	3.205	1.075	1	5
[2]	Gender (1 = male)	0.723	0.448	0	1
[3]	Age	38.760	11.537	23	65
[4]	Occupational status (1 = professor, 0 = other)	0.180	0.385	0	1
[5]	Research (1 = applied, 0 = basic)	0.560	0.497	0	1
[6]	Engineering sciences (1 = yes)	0.323	0.468	0	1
[7]	Natural sciences (1 = yes)	0.495	0.501	0	1
[8]	Social sciences (1 = yes)	0.183	0.387	0	1
[9]	Entrepreneurial experience (1 = yes)	0.118	0.322	0	1
[10]	Affective attitude	3.440	0.949	1.000	5.000
[11]	Cognitive attitude	0.045	10.485	-36.000	34.000
[12]	Perceived behavioral control	2.994	0.986	1.000	5.000
[13]	Injunctive norm	2.670	0.984	1.000	5.000
[14]	Descriptive norm	1.585	0.637	1.000	4.500
[15]	Group identification	3.405	0.767	1.000	5.000
[16]	Conscientiousness	3.404	0.628	1.556	4.889
[17]	Extraversion	2.954	0.666	1.000	4.667
[18]	Agreeableness	3.173	0.577	1.111	4.778
[19]	Openness	3.222	0.582	1.444	4.875
[20]	Neuroticism	1.675	0.659	0.111	4.000

intentions, which is in line with our conceptual model (see Fig. 1). As expected, there are also significant correlations between the Five-Factor personality traits (*conscientiousness*, *extraversion*, *agreeableness*, *openness*, *neuroticism*) and the TPB factors and between the Five-Factor traits and the outcome variable. To control for the existence of multicollinearity, variance inflation factors (VIF) were calculated for all study variables (not shown here). VIF scores range from 1.12 (agreeableness) to 2.22 (engineering sciences). These values are below the critical value of 5 (Hair et al. 2010), and thus multicollinearity is unlikely to be a concern in the present study.

4.2 Prediction of entrepreneurial intentions via the extended TPB framework

In the first step of the analysis, we attempted to identify potential entrepreneurs – whether of the Schumpeter type or not – in a representative sample of academic scientists. We investigated the degree to which intentions to economize on own research results via founding a firm can be explained by the intention predictors in the theory of planned behavior (TPB) as well as scientist’s group identification with workplace peers.

Given the ordinal nature of the dependent variable entrepreneurial intentions, this analysis relies on ordered logistic regression (or “ordered logit”). An ordered logit assumes that the dependent variable can be ordered but does not assume the same distance between adjacent categories of the dependent variable (Long 1997). Table 3

Table 2 Correlations

Variables	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]	[12]	[13]	[14]	[15]	[16]	[17]	[18]	
[1] Entrepreneurial intentions	1																		
[2] Gender (1 = male)	0.15	1																	
[3] Age	-0.02	0.24	1																
[4] Occupational status (1 = professor; 0 = other)	0.03	0.23	0.52	1															
[5] Research (1 = applied, 0 = basic)	0.12	0.13	0.16	0.02	1														
[6] Engineering sciences (1 = yes)	0.11	0.12	0.10	0.02	0.34	1													
[7] Natural sciences (1 = yes)	-0.10	-0.08	0.01	-0.06	-0.30	-0.68	1												
[8] Entrepreneurial experience (1 = yes)	0.33	0.17	0.24	0.23	0.12	0.11	-0.11	1											
[9] Affective attitude	0.53	0.07	-0.04	-0.05	0.22	0.16	-0.12	0.27	1										
[10] Cognitive attitude	0.23	-0.03	-0.13	-0.00	0.03	-0.01	0.01	0.09	0.25	1									
[11] Perceived behavioral control	0.52	0.26	0.11	0.18	0.18	0.13	-0.18	0.37	0.54	0.24	1								
[12] Injunctive norm	0.32	0.09	-0.07	-0.04	0.06	0.11	-0.06	0.18	0.36	0.18	0.28	1							
[13] Descriptive norm	0.15	0.16	0.19	0.14	0.17	0.28	-0.18	0.20	0.19	0.01	0.25	0.28	1						
[14] Group identification	0.06	0.08	-0.00	-0.02	-0.03	0.01	0.07	0.11	0.00	0.00	0.04	0.15	0.00	1					
[15] Conscientiousness	0.13	-0.06	0.12	0.07	0.02	0.01	-0.01	0.07	0.12	0.08	0.17	0.01	0.02	0.11	1				
[16] Extraversion	0.09	-0.07	0.09	0.11	0.02	0.07	-0.18	0.08	0.21	0.16	0.21	0.12	0.01	0.23	0.17	1			
[17] Agreeableness	0.09	-0.00	0.09	0.05	0.02	0.13	-0.01	0.12	0.05	0.02	0.07	0.08	0.00	0.11	0.17	0.07	1		
[18] Openness	0.22	-0.02	0.03	0.11	-0.03	-0.01	-0.10	0.19	0.25	0.21	0.26	0.12	0.07	-0.04	0.16	0.34	0.04	1	
[19] Neuroticism	-0.19	-0.13	-0.12	-0.13	-0.05	-0.07	0.05	-0.16	-0.29	-0.13	-0.37	-0.16	-0.08	-0.16	-0.30	-0.40	-0.21	-0.23	1

Bold values are significant at $p < 0.05$

shows the results. As regards the control variables in model 1, we find *gender* and *entrepreneurial experience* to predict positively entrepreneurial intentions, while *age* negatively relates to entrepreneurial intentions. Hence, younger and male scientists as well as researchers with entrepreneurial experience report stronger intentions to become an entrepreneur.

In Hypothesis 1, we had expected that the TPB variables would positively predict entrepreneurial intentions. As can be seen in Model 2, we found a positive effect for *affective attitude*. By contrast, *cognitive attitude* remains insignificant. The latter result may be explained by the fact that we measured intentions to become an entrepreneur *conditional* on the commercial orientation of scientists' research activity. Hence, the cognitive dimension of attitudes towards entrepreneurship may play a minor role here. Moreover, *perceived behavioral control* shows a positive relationship with entrepreneurial intentions. Participants scoring high on this TPB predictor may be more strongly convinced of their own ability to perform the entrepreneurial role and thus are more likely to show intentions to do so. The remaining TPB variables *injunctive norm* and *descriptive norm* both refer to the influence of the proximate work context (i.e., scientists' academic workplace peers) on their willingness to engage in entrepreneurial behavior. *Injunctive norm* turned out positive and significant, thus supporting the idea that scientists' perception whether workplace peers would welcome and sustain their engagement in entrepreneurship determines academic entrepreneurial intentions. *Descriptive norm* (i.e. scientists' perception of their workplace peers actual engagement in entrepreneurial activity) shows up as insignificant. Taking these results together, we have to conclude that Hypothesis 1 is only partly supported.

Model 3 incorporates *group identification* as an additional intention predictor, extending the TPB framework. As was proposed in Hypotheses 2a and 2b, we tested interaction effects between *group identification* and the two dimensions of social norms, *injunctive norm* and *descriptive norm*. We found the interaction effect between *group identification* and *injunctive norm* to be significant. The positive significant coefficient tells us that for scientists with higher peer *group identification*, the *injunctive norm* becomes relevant. On the other hand, for scientists who report lower levels of identification with their workplace peers, normative pressure to perform or not perform a certain behavior, such as captured by the *injunctive norm* variable, becomes less important for the individual decision to engage in entrepreneurship. With respect to the interaction between *group identification* and *descriptive norm*, no significant effect is found. Hence, Hypothesis 2a is supported, while Hypothesis 2b has to be rejected.

Next, we looked more closely at the role of scientists' *group identification* in the predication intentions to become an entrepreneur. We used a median split of the scores on the variable *group identification* to produce two groups: participants scoring low on *group identification* ("non-identifiers") and participants scoring high on *group identification* ("identifiers").¹ We then conducted a series of mean difference tests. The two groups differ in injunctive norm ($t[398] = -1.91, p < .10$), but not in affective attitude ($t[398] = 1.01, ns$), cognitive attitude ($t[398] = .14, ns$), perceived behavioral control ($t[398] = -.54, ns$), and descriptive norm ($t[398] = -1.27, ns$). The non-identifiers reported lower levels of injunctive norm ($M = -0.08, SD = .07$) than the identifiers

¹ Alternatively, we preferred a mean split over a median split of the group identification variable to produce the two groups of low and high identifiers. The results remained the same.

Table 3 Extended TPB model and entrepreneurial intentions (Ordered logit)

Dependent variable: Entrepreneurial intentions	Model 1 Full sample	Model 2 Full sample	Model 3 Full sample	Model 4 Non- identifiers	Model 5 Identifiers
Control variables					
Gender (1 = male)	0.490* (0.216)	0.222 (0.231)	0.222 (0.230)	0.308 (0.322)	0.193 (0.370)
Age	-0.023* (0.010)	-0.011 (0.010)	-0.013 (0.010)	-0.009 (0.014)	-0.014 (0.015)
Occupational status (1 = professor, 0 = other)	-0.008 (0.282)	-0.069 (0.293)	-0.017 (0.296)	-0.293 (0.400)	0.060 (0.449)
Research (1 = applied, 0 = basic)	0.316 (0.204)	-0.049 (0.214)	-0.081 (0.215)	0.010 (0.317)	-0.259 (0.324)
Engineering sciences (1 = yes)	0.199 (0.276)	0.286 (0.292)	0.304 (0.295)	0.379 (0.370)	0.032 (0.479)
Natural sciences (1 = yes)	0.090 (0.252)	0.246 (0.268)	0.251 (0.272)	0.554 (0.351)	-0.380 (0.434)
Entrepreneurial experience (1 = yes)	0.667*** (0.099)	0.357*** (0.105)	0.334** (0.106)	0.533*** (0.126)	0.138 (0.147)
TPB variables					
Affective attitude		0.681*** (0.128)	0.677*** (0.129)	0.997*** (0.187)	0.372† (0.200)
Cognitive attitude		0.139 (0.102)	0.149 (0.104)	0.123 (0.151)	0.134 (0.156)
Perceived behavioral control		0.742*** (0.136)	0.713*** (0.135)	0.407* (0.189)	1.398*** (0.233)
Injunctive norm		0.251* (0.105)	0.239* (0.106)	0.087 (0.142)	0.403* (0.168)
Descriptive norm		-0.105 (0.109)	-0.086 (0.110)	-0.040 (0.154)	-0.203 (0.172)
Interaction effects					
Group identification			0.088 (0.101)		
Injunctive norm x Group identification			0.172† (0.098)		
Descriptive norm x Group identification			0.127 (0.099)		
N of observations	400	400	400	213	187
LR chi-square	65.269	206.062	212.294	98.177	132.087
Prob > chi-square	0.000	0.000	0.000	0.000	0.000
Log likelihood	-547.588	-477.191	-474.075	-254.384	-209.845
Pseudo R-squared	0.056	0.178	0.183	0.160	0.239

Standard errors in parentheses, *** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$, † $p < 0.10$

($M=0.11$, $SD=.08$). Note that for the creation of the scales for the TPB variables we used z-standardized values of the respective items. Moreover, the two groups do not differ in their entrepreneurial intentions ($t[398]=-0.81$, ns). Finally, with respect to the control variables, we found group differences in gender ($\chi^2[1]=3.96$, $p<.05$) and entrepreneurial experience ($\chi^2[1]=6.24$, $p<.05$) but not in age ($t[398]=-0.70$, ns), occupational status (professor: no/yes; $\chi^2[1]=.01$, ns), research ($\chi^2[1]=.12$, ns), engineering science ($\chi^2[1]=.13$, ns) and natural science ($\chi^2[1]=.47$, ns). The share of female scientists is higher in the group of non-identifiers ($M=0.32$, $SD=.47$) than in the group of identifiers ($M=0.23$, $SD=.42$). Additionally, the non-identifiers have less entrepreneurial experience ($M=0.08$, $SD=.27$) than the identifiers ($M=0.16$, $SD=.37$).

Regression results for our sample of academic scientists split into “non-identifiers” and “identifiers” are provided in Models 4 and 5 of Table 3, respectively. As regards the TPB variables, there are some commonalities and some differences between the two subsamples. The commonalities are found with respect to *cognitive attitude* and *descriptive norm*. In both subsamples, the coefficients of these two TPB variables are not significant. The significant coefficient of *injunctive norm* for the subsample of “identifiers” supports our previous estimations employing the full sample. With respect to the significant coefficients for *affective attitude* and *perceived behavioral control*, the following pattern across both subsamples emerges:

First, for scientists with low *group identification*, we found a much higher and positive coefficient for *affective attitude* than for their peer group oriented counterparts. Hence, conforming individuals, on the average, show a lower degree of *affective attitude* towards creating an own entrepreneurial firm compared to their deviant counterparts.

Second, for both subgroups, *perceived behavioral control* is a positive and significant predictor of entrepreneurial intentions. Interestingly, *perceived behavioral control* seems to be more important for individuals reporting an above average degree of peer *group identification*. This latter result is somewhat surprising because one could have argued that a deviant individual’s entrepreneurial intentions are heavily based on own perceptions of control over the entrepreneurial process. However, on second sight, those scientists who show high entrepreneurial intentions and also strongly identify with their peers might derive such control perceptions just from their belonging to the peer group.

4.3 Identifying Schumpeterian deviants and conforming followers

Building on the previous analysis of potential entrepreneurs, in this subsection we identify those individuals who act as deviant Schumpeterian entrepreneurs rather than another type of new firm founder who tends to more strongly conform to the peer group. The results should allow us to answer the question of whether the Schumpeterian deviant is a rare case or not.

For that purpose, we again use the two groups of “non-identifiers” ($N=213$) and “identifiers” ($N=187$). For both subsamples we cross-tabulated *entrepreneurial intentions* and *injunctive norm*. We used a re-scaled intention variable that contains three categories: higher, medium, and lower intention levels. A median split of the scores on *injunctive*

Table 4 Non-identifiers

		Injunctive norm	
		low	high
Non-identifiers			
Entrepreneurial intentions	low	33 (8 %)	13 (3 %)
	moderate	58 (15 %)	31 (8 %)
	high	44 (11 %)	34 (9 %)

norm was performed in order to create a dummy variable that distinguishes between higher and lower levels of perceived social expectations towards engaging in entrepreneurship. Tables 4 and 5 displays the cross-tables for the “non-identifiers” and “identifiers”.

In Table 4, we analyzed the subsample of “non-identifiers”, i.e. those scientists who reported lower levels of identification with the group of workplace peers. Absolute numbers and percentages to the total number of observations in the full sample are provided. We first found that the category of scientists reporting medium levels of *entrepreneurial intentions* is the most frequent with 23 % (15 % of scientists reporting low levels of injunctive norm and 8 % of scientists reporting high levels of injunctive norm) out of the full sample. The number of scientists with higher levels of intentions who deviated from the opinion of their peers is 44 (11 %). These deviants can be interpreted as entrepreneurs in the very Schumpeterian sense – they have intentions to become an entrepreneur *against all odds* (i.e. although their peers would not approve of entrepreneurial activity) and are hence *Schumpeterian*. The other 34 scientists (9 %) reporting higher levels of entrepreneurial intentions seem to follow their peers' positive opinion about entrepreneurship (i.e. higher levels of injunctive norm), although they do not identify with them; they cannot be considered as *Schumpeterian entrepreneurs*, but appear to be *following the crowd*. The remaining 11 % of “non-identifiers” in the full sample show no intentions to found a firm; of those, the majority (8 %) seem to follow the peers' negative opinion about commercialization of scientific research via founding an own firm.

Table 5 Identifiers

		Injunctive norm	
		low	high
Identifiers			
Entrepreneurial intentions	low	33 (8 %)	10 (3 %)
	moderate	43 (11 %)	24 (6 %)
	high	24 (6 %)	53 (13 %)

In Table 5, the subsample of scientists showing a higher degree of peer group identification (“identifiers”) is considered. Looking at the potential founders (lower row of Table 5), the majority of 53 compared to 24 scientists (or 13 % compared to 6 %) seem to follow the positive opinion their peers have about founding an own firm – they conform and *follow the crowd*. Of the 11 % of “identifying” potential non-founders (upper row of Table 5) the vast majority (8 %) is likely to follow their peers.

Summarizing these results with respect to the notion of potential entrepreneurs in Schumpeter’s sense, among the 155 scientists with positive entrepreneurial intentions (39 % of the full sample), 44 follow the Schumpeter pattern of behaving deviant, 53 are more likely to be conformists and the remaining 58 stay somewhere in between these two extremes. In this sense, deviants and conformists are with 11 % and 13 % quite equal off and the Schumpeterian type appears not to be a rare case among those scientists with a high entrepreneurial intention.

This result can be complemented by information as to whether entrepreneurial intentions led to the creation of a science-based new firm. To investigate this intentions-behavior link, we conducted a follow-up survey 18 months after the initial survey in June 2008 (T1). Here, respondents were asked whether they had pursued entrepreneurship since T1. In December 2009 (T2), we were able to collect follow-up data on entrepreneurial behavior from 194 of our participants, using the item “Since the last survey in June 2008, did you participate in the founding of a firm to commercialize your research?” We found that, in case of the Schumpeterian deviants, 10 % indeed created a new business, whereas among the conformists we found a share of entrepreneurs of 19 % - conformists appear to more easily take the step from intention to behavior. Applied to our sample of 400 scientists, this implies that 1.1 % of the scientists founded a new business as Schumpeterian deviants, whereas 2.5 % did so as conformists. Taking into account that the businesses created by the conformists are all started in teams, whereas among the Schumpeterian deviants half of them founded their firms as a solo entrepreneur, then the *solo* Schumpeterian deviant with 0.55 % is indeed a rare case.

4.4 Personality traits as distal intention predictors

Following the analysis of entrepreneurial intentions using the extended TPB model, in a further step we wanted to know whether and how Five-Factor personality traits as deeper level psychological traits drive our results and whether they dominate the proximate TPB determinants. This kind of analysis is of particular importance, as the results may be helpful when designing appropriate entrepreneurship policies that address the individual level or the social context of potential entrepreneurs: contrary to the TPB determinants, the distal Five-Factor personality traits are considered to be nature given and hence cannot be “manipulated” via any measures of entrepreneurship policy. If the TPB variables appear to dominate the Five-Factor traits in influencing the intention to found a new firm, policy options become apparent. In the opposite case, policy considerations tend to be rather limited.

In order to shed light upon this issue, we tested for our hypothesized relationships between the Five-Factor personality traits and the intention to become an innovative entrepreneur (Hypotheses 3a-3e). Table 6 presents the results. In Model 1, we found that the personality trait *conscientiousness* contributes slightly significantly (at $p < 0.10$) to the prediction of entrepreneurial intentions, validating Hypothesis 3a. Participants scoring high on *conscientiousness* tend to exhibit grit, hard work and effort in

Table 6 Five-Factor personality traits and entrepreneurial intentions (Ordered logit)

Dependent variable: Entrepreneurial intentions	Model 1	Model 2
Control variables		
Gender (1 = male)	0.573* (0.225)	0.259 (0.238)
Age	-0.026** (0.010)	-0.011 (0.010)
Occupational status (1 = professor, 0 = other)	-0.139 (0.286)	-0.060 (0.297)
Research (1 = applied, 0 = basic)	0.357† (0.206)	-0.044 (0.215)
Engineering sciences (1 = yes)	0.258 (0.285)	0.290 (0.300)
Natural sciences (1 = yes)	0.161 (0.263)	0.229 (0.277)
Entrepreneurial experience (1 = yes)	1.958*** (0.333)	1.089** (0.346)
TPB variables		
Affective attitude		0.691*** (0.131)
Cognitive attitude		0.131 (0.103)
Perceived behavioral control		0.762*** (0.139)
Injunctive norm		0.268* (0.106)
Descriptive norm		-0.114 (0.109)
Five-Factor personality traits		
Conscientiousness	0.282† (0.158)	0.190 (0.161)
Extraversion	0.058 (0.165)	-0.154 (0.175)
Agreeableness	0.060 (0.170)	0.116 (0.172)
Openness	0.452* (0.179)	0.201 (0.190)
Neuroticism	-0.252 (0.166)	0.207 (0.177)
LR chi-square	86.770	210.705
Prob > chi-square	0.000	0.000
Log likelihood	-536.837	-474.869
Pseudo R-squared	0.075	0.182

Standard errors in parentheses, *** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$, † $p < 0.10$, $N = 400$

accomplishing difficult tasks such as those related to creating a new innovative business. Second, and supporting Hypothesis 3d, the coefficient for the trait *openness* is positively significant (at $p < 0.05$) and almost twice as powerful as the coefficient for *conscientiousness*. Hence, those individuals open to new ways and issues are much more likely to show entrepreneurial intentions. The remaining Five-Factor traits, *neuroticism*, *agreeableness* and *extraversion*, are not significantly related to the intentions variable. Hypotheses 3b, 3c, and 3e have to be rejected. An explanation might be the specific focus of our sample on academic scientists, which may be much more homogenous in these personality dimensions than other samples of potential entrepreneurs outside of academia.

Model 2 adds the TPB variables to the regression equation. Five-Factor traits completely lose their explanatory power. Providing support for Hypothesis 4, our results show that personality characteristics do not predict entrepreneurial intentions over and beyond the effect of the TPB variables. This is not entirely surprising, as it indicates that more proximate predictors of entrepreneurial intentions, such as in the TPB framework, offer a higher explanatory power than the more distal personality variables.

Given that, we next explored the relationship between the variables of the extended TPB framework and the Five-Factor personality traits. The presumption is that those intention predictors that are on the individual level – *affective attitude*, *cognitive attitude*, *perceived behavioral control*, and *group identification* – show a significant relation to the Five-Factor personality traits, whereas the context-related social norm variables – *injunctive* and *descriptive norm* – do not.

Results of OLS regressions with each of the TPB variables serving as a dependent variable (Models 1–5) are provided in Table 7. Starting with the individual-level TPB variables *affective attitude* (Model 1) and *perceived behavioral control* (Model 3), three of the Five-Factor traits are significant and show the expected sign (*extraversion*, *openness*, and *neuroticism* for *affective attitude*; *openness* and *neuroticism* for *perceived behavioral control*). Moreover, for *cognitive attitude* (Model 2) and *group identification* (Model 6) the personality traits *conscientiousness*, *extraversion* and *openness* play a role. These results validate Hypothesis 5a on a significant relationship between individual-level intention predictors and personality. As expected, the context-level intention predictors *injunctive norm* (Model 4) and *descriptive norm* (Model 5) show no relation to the Five-Factor personality traits. Hypothesis 5b is thus supported by the data.

Given that the personality trait *openness* is considered as an important characteristic of entrepreneurs, our results in Table 7 complement prior literature by indicating that the entrepreneurial type shows a more positive attitude towards entrepreneurship (with respect to both dimension of attitude, *affective* and *cognitive*) as well as a higher degree of perceived ability to perform entrepreneurial activity (i.e. *perceived behavioral control*). In addition, the negative relationship between *openness* and *group identification* is in line with the characterization of the Schumpeterian entrepreneur as acting *against all odds*. It turns out that entrepreneurs who are more open to new experiences seem to be less likely to identify with, and to act according to, the expectations of their social environment.

These findings are interesting along the following lines: First of all, they suggest that mediation effects work and one may want to investigate via which TPB variables the

Table 7 Five-Factor personality traits and the extended TPB framework (OLS)

	Model 1 Affective attitude	Model 2 Cognitive attitude	Model 3 Perceived behavioral control	Model 4 Injunctive norm	Model 5 Descriptive norm	Model 6 Group identification
Constant	-0.783 (0.564)	-0.938 (0.613)	-0.627 (0.526)	-0.408 (0.623)	-0.357 (0.597)	-1.341* (0.592)
Control variables						
Gender (1 = male)	0.102 (0.106)	-0.007 (0.115)	0.403*** (0.099)	0.207† (0.117)	0.140 (0.112)	0.263* (0.111)
Age	-0.011* (0.005)	-0.018*** (0.005)	-0.007† (0.004)	-0.013* (0.005)	0.008 (0.005)	-0.007 (0.005)
Occupational status (1 = professor, 0 = other)	-0.256† (0.138)	0.144 (0.150)	0.164 (0.129)	-0.120 (0.152)	0.097 (0.146)	-0.130 (0.145)
Research (1 = applied, 0 = basic)	0.364*** (0.096)	0.137 (0.105)	0.218* (0.090)	0.048 (0.107)	0.105 (0.102)	-0.070 (0.101)
Engineering sciences (1 = yes)	0.242† (0.136)	0.093 (0.147)	-0.076 (0.127)	0.279† (0.150)	0.567*** (0.144)	0.205 (0.142)
Natural sciences (1 = yes)	0.148 (0.127)	0.208 (0.138)	-0.189 (0.119)	0.170 (0.140)	0.067 (0.134)	0.369*** (0.133)
Entrepreneurial experience (1 = yes)	0.702*** (0.147)	0.233 (0.160)	0.754*** (0.137)	0.521*** (0.163)	0.377* (0.156)	0.364* (0.154)
Five-Factor personality traits						
Conscientiousness	0.058 (0.075)	0.071 (0.082)	0.109 (0.070)	-0.049 (0.083)	-0.002 (0.080)	0.136† (0.079)
Extraversion	0.132† (0.077)	0.145† (0.084)	0.058 (0.072)	0.119 (0.085)	-0.086 (0.082)	0.439*** (0.081)

Table 7 (continued)

Dependent variables:	Model 1 Affective attitude	Model 2 Cognitive attitude	Model 3 Perceived behavioral control	Model 4 Injunctive norm	Model 5 Descriptive norm	Model 6 Group identification
Agreeableness	-0.055 (0.080)	-0.019 (0.087)	-0.033 (0.075)	0.069 (0.088)	-0.112 (0.085)	0.106 (0.084)
Openness	0.260** (0.083)	0.272** (0.090)	0.215** (0.077)	0.107 (0.092)	0.096 (0.088)	-0.267** (0.087)
Neuroticism	-0.276*** (0.079)	-0.070 (0.086)	-0.351*** (0.073)	-0.139 (0.087)	-0.064 (0.083)	-0.034 (0.083)
F(12, 387)	9.986	3.392	14.832	3.375	5.458	5.046
Prob > F	0.000	0.000	0.000	0.000	0.000	0.000
R-squared	0.236	0.095	0.315	0.095	0.145	0.135
Adj. R-squared	0.213	0.067	0.294	0.067	0.118	0.108

Standard errors in parentheses, *** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$, † $p < 0.10$, $N = 400$

basic psychological traits relate to entrepreneurial intentions; in fact, any mediation effect could be an indication for the respective TPB variable to be a characteristic adaptation of the fundamental Five-Factor traits. Second, since the personality traits do not dominate the TPB variables there remains room for policy intervention.

5 Discussion

The purpose of this study was to investigate Schumpeterian deviant behavior in the decision to engage in entrepreneurial activity. Schumpeter's conception of entrepreneurship and of entrepreneurs centers on the personality traits of the individuals who take personal initiative. Entrepreneurs are described as 'energetic' types who do not merely adapt to changing circumstances, but challenge conventional wisdom to overcome social resistance and skepticism. Following from Schumpeter's theory, it was our expectation that the entrepreneurial career choice of Schumpeterian innovator-entrepreneurs is mainly driven by individual predispositions and attitudes, whereas expectations and conventions of the social context should play a negligible role if at all.

Drawing from Ajzen's (1991) theory of planned behavior (TPB), social identity theory (Tajfel and Turner 1979; Hogg and Abrams 1988), self-categorization theory (Turner et al., 1987) and the Five-Factor model of personality (Schmitt-Rodermund 2004, 2007; Zhao and Seibert 2006; Rauch and Frese 2007; Zhao et al. 2009), we developed several propositions on the influence of individual and contextual characteristics on entrepreneurial career intentions. To test these propositions, we used a representative sample of academic scientists. This enabled us to examine entrepreneurial motivations in a population where the potential for innovative entrepreneurship is particularly high (i.e., the creation of new research findings constantly provides a fertile ground for the creation of innovative business ideas).

As a first result, we found that, among scientists in our sample who are seriously considering starting an own business, the share of those who show a Schumpeter pattern of deviant behavior is rather small, while the majority of potential academic entrepreneurs seem to start an entrepreneurial career in order to conform to the positive opinion of their social peers about entrepreneurship. In fact, it seems that Schumpeter's conception of an entrepreneur is a rare case.

Second, regarding the prediction of entrepreneurial intentions, the Five-Factor personality traits show the expected influence. However, when including the more proximate TPB variables, the Five-Factor personality traits lose their explanatory power completely.

Third, turning to the individual-level predictors of the TPB model (i.e., attitudes, perceived behavioral control), our hypotheses are widely supported by the data. Regarding scientists' attitudes toward entrepreneurship, the emotional component (affective attitude) turns out to be a relevant predictor, while the rational component (cognitive attitude) does not have an effect. It is, therefore, a positive feeling and opinion toward research commercialization that predicts scientists' intentions to engage in entrepreneurial activity. This is in line with more general research on entrepreneurial cognitions emphasizing the "emotional underpinning" of entrepreneurial behavior in non-academic settings (e.g., Smilor 1997; Cardon et al. 2009).

Furthermore, perceived behavioral control emerges as a key predictor of entrepreneurial intentions. This concurs with a growing body of research underlining the importance of entrepreneurial control-beliefs (e.g., self-efficacy beliefs) within the entrepreneurial process (see e.g., Obschonka et al. 2010; Rauch and Frese 2007). The significant relation between these control-beliefs and entrepreneurial intentions further highlights the importance of policy initiatives and support programs aiming to increase the rate of start-ups from the science field. In this regard, sensitizing and qualifying scientists for an entrepreneurial career could be pointed out as a potentially effective strategy.

Fourth, it is notable that context-level parameters, i.e., descriptive norm (whether workplace peers actually engage in entrepreneurship) and injunctive norm (whether workplace peers would approve of the respondent's entrepreneurial activity), do not emerge as strong direct predictors of entrepreneurial career intentions. Two explanations for our findings are plausible:

On the one hand, individual-level factors, such as personal attitudes, control-beliefs, or self-perceptions, might be more influential with respect to entrepreneurial activity than the social context, i.e., a scientist's group of workplace peers. Similarly, Krueger et al. (2000) suppose that the "lone entrepreneur's" tendency toward inner-directedness might reduce the impact of social forces.

On the other hand, there might be boundary conditions determining the influence of the social context on the decision to engage in entrepreneurship. Indeed, we find the effect of injunctive norm on entrepreneurial intentions to be moderated by group identification (i.e., a scientist's sense of identification with his or her group of workplace peers). Note that we do not find such an effect for descriptive norm. This corroborates the distinct nature of peer influences modeled by these two norm constructs. Injunctive norm refers to whether entrepreneurial behavior *ought* to be shown by members of the research department, implying concrete behavioral expectations of the group of workplace peers. Descriptive norm captures whether entrepreneurial behavior *is* actually shown by members of the group of workplace peers. However, it does not explicitly impose social pressure to conform and does not show any effect on entrepreneurial intentions. Adding to previous research (Louis et al. 1989; Kenney and Goe 2004; Stuart and Ding 2006), these findings demonstrate that instead of working in close proximity to entrepreneurial peers, it seems to be *the will to comply with social pressure* that stimulates academic entrepreneurial activity.

5.1 Implications for policy

Given today's radical social and economic changes, public authorities strive for mechanisms that enable individuals and societies to adapt actively and to respond to the new challenges (Silbereisen 2005). Moreover, economists emphasize the importance of entrepreneurship as an individual's career choice and the entrepreneurial exploitation of scientific research as a particular driver of economic growth (Audretsch 2007). Consequently, policy schemes targeting academic entrepreneurship might be particularly important. In this respect, our study suggests that interventions focusing on affective attitudes and entrepreneurial control-beliefs might be particularly promising. Our result that the more proximate TPB factors

dominate the Five-Factor personality traits – which are rather given by nature and therefore may be difficult to “manipulate” – opens up room for additional political measures. Interventions informed by intentions-based models, such as the theory of planned behavior (Ajzen 1991), have already proved to be efficacious in changing intentions and behavior among participants who, prior to the intervention, either did not contemplate performing the behavior or were disinclined to do so (Fishbein and Ajzen 2005). Likewise, there is a growing body of empirical evidence indicating that interventions are able to promote entrepreneurial mindsets (e.g., attitudes, self-efficacy beliefs; see Krueger 2007) and intentions (Souitaris et al. 2007). Consequently, entrepreneurship scholars strongly recommend the use of intentions-based models in the context of entrepreneurship education and training (e.g., Fayolle 2005). For example, a targeted intervention could teach scientists critical entrepreneurial competencies to foster perceived behavioral control (Krueger et al. 2000). Information provision and persuasive communication (see Hardeman et al. 2002) to demonstrate convincingly the benefits of entrepreneurship might help change attitudes and create an entrepreneurial self-perception.

Public support schemes may further benefit from understanding that norms and rules of the social environment strongly determine entrepreneurial activity. Specifically, the importance of injunctive norm (i.e., a peer group's expectations toward entrepreneurial engagement) advocates an active role for workplace peers in providing positive pressure to perform entrepreneurial behavior. Policy interventions thus should be designed to both foster a departmental climate that favors entrepreneurship and strengthen group identification (i.e., scientists' feelings of belongingness to their own group of workplace peers) in order to assist in developing stronger entrepreneurial intentions in academia. On the other hand, however, our results suggest that such context-related measures would be more likely to promote entrepreneurial activity that complies with social rules and expectations rather than entrepreneurship as rule-breaking, deviant behavior. In view of these political options, the means to “create” the Schumpeter-type entrepreneur appear to be very limited.

5.2 Limitations

This study has several limitations. First, the data used are correlational in nature but our results concur with past empirical research on the TPB, social identity, and the Five-Factor model of personality. Second, all information is collected from the same source, namely, from the individual scientist, and by means of the same method (online questionnaire). Future research may take into account multi-informant/multi-method procedures to consider other sources and methods as well. A third caveat is that we focused on the population of German scientists and the phenomenon of academic entrepreneurship. At first glance, this might come at the expense of a more general application of our results in other national contexts and with respect to other types of entrepreneurship (e.g. corporate venturing). However, since we applied a very broad and general theoretical framework, our findings may well apply to other countries and populations (e.g., former employees spinning off new businesses from large incumbent firms).

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Compliance with ethical standards

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References

- Ajzen I (1991) The theory of planned behavior. *Organ Behav Hum Decis Process* 50:179–211
- Ajzen I (2002) Construction of a standard questionnaire for the theory of planned behavior, online available: <http://www-unix.oit.umass.edu/~ajzen/> (10.06.2008)
- Ajzen I, Fishbein M (1980) Understanding attitudes and predicting social behavior. Prentice Hall, Englewood Cliffs
- Ajzen I, Madden TJ (1986) Prediction of goal-directed behavior: attitudes, intentions and perceived behavioral control. *J Exp Soc Psychol* 22(5):453–474
- Ajzen I, Brown TC, Carvajal F (2004) Explaining the discrepancy between intentions and actions: the case of hypothetical bias in contingent valuation. *Personal Soc Psychol Bull* 30(9):1108–1121
- Audretsch DB (2007) The entrepreneurial society. Oxford University Press, New York
- Bandura A (1997) Self-efficacy: the exercise of control. W. H. Freeman, New York
- Barrick MR, Mount MK, Gupta R (2003) Meta-analysis of the relationship between the five-factor model of personality and Holland's occupational types. *Pers Psychol* 56(1):45–74
- Baum JR, Locke EA (2004) The relationship of entrepreneurial traits, skill, and motivation to subsequent venture growth. *J Appl Psychol* 89(4):587–598
- Bercovitz J, Feldman M (2008) Academic entrepreneurs: organizational change at the individual level. *Organ Sci* 19(1):69–89
- Bird BJ (1988) Implementing entrepreneurial ideas: the case for intention. *Acad Manag Rev* 13(3):442–453
- Cardon MS, Wincnet J, Singh J, Drnovsek M (2009) The nature and experience of entrepreneurial passion. *Acad Manag Rev* 34(3):511–532
- Chen CC, Greene PG, Crick A (1998) Does entrepreneurial self-efficacy distinguish entrepreneurs from managers? *J Bus Ventur* 13(4):295–316
- Cialdini RB, Reno RR, Kallgren CA (1990) A focus theory of normative conduct: recycling the concept of norms to reduce littering in public places. *J Pers Soc Psychol* 58(6):1015–1026
- Conner M, McMillan B (1999) Interaction effects in the theory of planned behaviour: studying cannabis use. *Br J Soc Psychol* 38(2):195–222
- Costa PT Jr, McCrae RR (1992) Revised NEO Personality Inventory (NEO PI-R) and NEO Five-Factor Inventory (NEO-FFI) professional manual. Odessa, FL
- Costa PT, McCrae RR, Holland JL (1984) Personality and vocational interests in an adult sample. *J Appl Psychol* 69(3):390–400
- Crites SL, Fabrigar LR, Petty RE (1994) Measuring the affective and cognitive properties of attitudes: conceptual and methodological issues. *Personal Soc Psychol Bull* 20(6):619–634
- Etzkowitz H (1998) The norms of entrepreneurial science: cognitive effects of the new university–industry linkages. *Res Policy* 27(8):823–833

- Fayolle A (2005) Evaluation of entrepreneurship education: behavior performing or intention increasing? *Int J Entrep Small Bus* 2(1):89–98
- Fayolle A, Liñán F (2014) The future of research on entrepreneurial intentions. *J Bus Res* 67(5):663–666
- Fielding KS, McDonald R, Louis WR (2008) Theory of planned behaviour, identity and intentions to engage in environmental activism. *J Environ Psychol* 28(4):318–326
- Fishbein M, Ajzen I (2005) Theory-based behavior change interventions: comments on hobbis and Sutton. *J Health Psychol* 10(1):27–31
- Fishbein M, Ajzen I (2010) *Predicting and changing behavior: the reasoned action approach*. Taylor, New York
- Goethner M, Obschonka M, Silbereisen RK, Cantner U (2012) Scientists' transition to academic entrepreneurship: economic and psychological determinants. *J Econ Psychol* 33(3):628–641
- Göktepe-Hulten D, Mahangaonkar P (2010) Inventing and patent activities of scientists: in the expectation of money or reputation? *J Technol Transfer* 35(4):401–423
- Gulbrandsen M (2005) "But Peter's in it for the money" – The liminality of entrepreneurial scientists. *VEST J Sci Technol Stud* 18(1–2):49–75
- Hair JF, Black WC, Babin BJ, Anderson RE (2010) *Multivariate data analysis: a global perspective*, 7th edn. Pearson, Prentice Hall
- Hardeman W, Johnston M, Johnston D, Bonetti D, Wareham N, Kinmonth AL (2002) Application of the theory of planned behaviour in behaviour change interventions: a systematic review. *Psychol Health* 17(2):123–158
- Hogg MH, Abrams D (1988) *Social identifications: a social psychology of intergroup relations and group processes*. Routledge, London
- Jang KL, Livesley WJ, Vernon PA (1996) Heritability of the big five personality dimensions and their facets: a twin study. *J Pers* 64(3):577–592
- John OP, Srivastava S (1999) The big five trait taxonomy: history, measurement, and theoretical perspectives. In: Pervin LA, John OP (eds) *Handbook of personality: theory and research*. Guilford Press, New York, pp 102–138
- Kautonen T, Gelderen M, Fink M (2015) Robustness of the theory of planned behavior in predicting entrepreneurial intentions and actions. *Entrep Theory Pract* 39(3):655–674
- Kenney M, Goe WR (2004) The role of social embeddedness in professorial entrepreneurship: a comparison of electrical engineering and computer science at UC Berkeley and Stanford. *Res Policy* 33(5):691–707
- Krueger NF (2007) What lies beneath? The experiential essence of entrepreneurial thinking. *Entrep Theory Pract* 31(1):123–138
- Krueger NF (2009) Entrepreneurial intentions are dead: long live entrepreneurial intentions. In: Carsrud AL, Brännback M (eds) *Understanding the entrepreneurial mind: opening the black box*. Springer, New York, pp 51–72
- Krueger NF, Carsrud AL (1993) Entrepreneurial intentions: applying the theory of planned behaviour. *Entrep Reg Dev* 5(4):315–330
- Krueger NF, Reilly MD, Carsrud AL (2000) Competing models of entrepreneurial intentions. *J Bus Ventur* 15(5):411–432
- Lahey BB (2009) Public health significance of neuroticism. *Am Psychol* 64(4):241–256
- Lam A (2011) What motivates academic scientists to engage in research commercialization: 'Gold', 'ribbon or 'puzzle'? *Res Policy* 40(10):1354–1368
- Landry R, Amara N, Rherrad I (2006) Why are some university researchers more likely to create spin-offs than others? Evidence from Canadian universities. *Res Policy* 35(10):1599–1615
- Lee L, Wong PK, Foo MD, Leung A (2011) Entrepreneurial intentions: the influence of organizational and individual factors. *J Bus Ventur* 26(1):124–136
- Leskinen R (2011) Success in the female entrepreneurial networking process. *Ann Innov Entrep* 2(1):6002
- Locke EA (2000) *The prime movers: traits of great wealth creators*. AMACOM, New York
- Long JS (1997) *Regression models for categorical and limited dependent variables*. Sage Publications, Thousand Oaks
- Louis KS, Blumenthal D, Gluck ME, Soto MA (1989) Entrepreneurs in academe: an exploration of behaviors among life scientists. *Adm Sci Q* 34(1):110–131
- Lundström A, Stevenson LA (2006) *Entrepreneurship policy: theory and practice*. Springer, New York
- Markman GD, Baron RA (2003) Person–entrepreneurship fit: why some people are more successful as entrepreneurs than others. *Hum Resour Manag Rev* 13(2):281–301
- Markman GD, Balkin DB, Baron RA (2002) Inventors and new venture formation: the effects of general self-efficacy and regretful thinking. *Entrep Theory Pract* 27(2):149–165
- McClelland DC (1961) *The achieving society*. Van Nostrand, Princeton

- Murray F, Graham L (2007) Buying science and selling science: gender differences in the market for commercial science. *Ind Corp Chang* 16(4):657–689
- O’Gorman C, Byrne O, Pandya D (2008) How scientists commercialise new knowledge via entrepreneurship. *J Technol Transfer* 33(1):23–43
- Obschonka M, Silbereisen RK, Schmitt-Rodermund E (2010) Entrepreneurial intention as developmental outcome. *J Vocat Behav* 77(1):63–72
- Obschonka M, Goethner M, Silbereisen RK, Cantner U (2012) Social identity and the transition to entrepreneurship: the role of group identification with workplace peers. *J Vocat Behav* 80(1):137–147
- OECD (2003) *Turning science into business*. OECD, Paris
- Ostendorf E (1990) *Sprache und Persönlichkeitsstruktur: Zur Validität des Fünf-Faktoren-Modells der Persönlichkeit [language and personality structure: toward the validation of the five-factor model of personality]*. Regensburg, Germany: S. Roeder Verlag
- Owen-Smith J, Powell W (2001) Careers and contradictions: faculty responses to the transformation of knowledge and its uses in the life sciences. *Res Sociol Work* 10:109–140
- Perkmann M, Tartari V, McKelvey M, Autio E, Broström A, D’Este P, Fini R, Geuna A, Grimaldi R, Hughes A, Krabel S, Kitson M, Llerena P, Lissoni F, Salter A, Sobrero M (2013) Academic engagement and commercialisation: a review of the literature on university–industry relations. *Res Policy* 42(2):423–442
- Rahm D (1994) Academic perceptions of university–firm technology transfer. *Policy Stud J* 22(2):267–278
- Rauch A, Frese M (2007) Born to be an entrepreneur? Revisiting the personality approach to entrepreneurship. In: Baum JR, Frese M, Baron RA (eds) *The psychology of entrepreneurship*. Erlbaum, Mahwah, pp 41–65
- Rothaermel FT, Agung SD, Jiang L (2007) University entrepreneurship: a taxonomy of the literature. *Ind Corp Chang* 16(4):691–791
- Schmitt-Rodermund E (2004) Pathways to successful entrepreneurship: parenting, personality, early entrepreneurial competence, and interests. *J Vocat Behav* 65(3):498–518
- Schmitt-Rodermund E (2007) The long way to entrepreneurship: personality, parenting, early interests, and competencies as precursors for entrepreneurial activity among the ‘Termites’. In: Silbereisen RK, Lerner RM (eds) *Approaches to positive youth development*. Sage, London, pp 205–224
- Schumpeter JA (1934) *The theory of economic development*. Oxford University Press, London
- Schumpeter JA (2002) New translations: theorie der wirtschaftlichen entwicklung. *Am J Econ Sociol* 61(2):405–437 (originally published in 1911)
- Shane SA (2004) *Academic entrepreneurship: university spinoffs and wealth creation*. Edward Elgar Publishing, Cheltenham
- Shaver KG, Scott LR (1991) Person, process, choice: the psychology of new venture creation. *Entrep Theory Pract* 16(2):23–45
- Silbereisen RK (2005) Presidential address. Social change und human development: experiences from German unification. *Int J Behav Dev* 29(1):2–13
- Singh G, DeNoble AF (2003) Views on self-employment and personality: an exploratory study. *J Dev Entrep* 8(3):265–281
- Smilor RW (1997) Entrepreneurship: reflections on a subversive activity. *J Bus Ventur* 12(5):341–346
- Souitaris V, Zerbinati S, Al-Laham A (2007) Do entrepreneurship programmes raise entrepreneurial intention of science and engineering students? The effect of learning, inspiration and resources. *J Bus Ventur* 22(4):566–591
- Statistisches Bundesamt (2008) *Bildung und kultur: personal an hochschulen [education and culture: personell at universities]*. Statistisches Bundesamt, Wiesbaden
- Stuart TE, Ding WW (2006) When do scientists become entrepreneurs? The social structural antecedents of commercial activity in the academic life sciences. *Am J Sociol* 112(1):97–144
- Tajfel H, Turner JC (1979) An integrative theory of intergroup conflict. In: Austin WG, Worchel S (eds) *The social psychology of intergroup relations*. Brooks-Cole, Monterey, pp 33–47
- Terry DJ, Hogg MA (1996) Group norms and the attitude-behavior relationship: A role for group identification. *Personal Soc Psychol Bull* 22(8):776–793
- Terry DJ, Hogg MA, White KM (1999) The theory of planned behaviour: self-identity, social identity and group norms. *Br J Soc Psychol* 38(3):225–244
- Turner JC, Hogg MA, Oakes PJ, Reicher SD, Wetherell MS (1987) *Rediscovering the social group: a self-categorization theory*. Oxford, UK: Basil Blackwell
- Wang JH, Chang CC, Yao SN, Liang C (2015) The contribution of self-efficacy to the relationship between personality traits and entrepreneurial intention. *High Educ* 1–16.
- Zhao H, Seibert SE (2006) The Big five personality dimensions and entrepreneurial status: a meta-analytical review. *J Appl Psychol* 91(2):259–271
- Zhao H, Seibert SE, Lumpkin GT (2009) The relationship of personality to entrepreneurial intentions and performance: a meta-analytical review. *J Manag* 36(2):381–404