



Contents lists available at ScienceDirect

# Journal of Business Venturing



## Unraveling the “passion orchestra” in academia



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### ARTICLE INFO

*Article history:*

Received 7 July 2014

Received in revised form 18 March 2016

Accepted 29 March 2016

Available online 30 April 2016

*Keywords:*

Passion

Identity theory

Entrepreneurial intentions

Academic entrepreneurship

Spin-offs

### ABSTRACT

This paper disentangles how organization members’ “passion orchestra” is related to their entrepreneurial intentions in the particularly relevant context of academia. Drawing on passion literature and identity theory, we propose and test a model linking two central parts of researchers’ “passion orchestra”, namely entrepreneurial and obsessive scientific passion, directly and indirectly, to spin-off and start-up intentions. While spin-off intentions refer to intentions to found a firm based upon research results, start-up intentions denote intentions to start any type of company. Using a sample of 2308 researchers from 24 European universities, our findings reveal that higher levels of entrepreneurial passion are associated with both stronger spin-off and start-up intentions. Further, obsessive scientific passion is positively associated with researchers’ intentions to create a spin-off, and negatively with their propensity to establish a start-up. Entrepreneurial self-efficacy and affective organizational commitment mediate these effects. Finally, the two types of passion show characteristic interactions. Obsessive scientific passion moderates the entrepreneurial passion–intentions relationship such that it strengthens spin-off intentions. Our results highlight that recasting the individual driven by a singular passion to one with a “passion orchestra” provides a more holistic understanding of the new venture creation process. Implications for research and practice are discussed.

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### 1. Executive summary

A growing volume of research indicates that entrepreneurial passion – which involves intense positive emotions and a meaningful identity connection – is central to the entrepreneurial experience and venture-related outcomes. Previous studies, however, have ignored that non-entrepreneurial passions may also shape the new venture creation process. Consequently, it is pertinent to uncover the consequences of multiple passions coming together in a person. Drawing on passion literature (Cardon et al., 2009; Vallerand et al., 2003) and identity theory (Stets and Burke, 2000; Stryker and Burke, 2000), we introduce the concept of a “passion orchestra”, i.e. the intraindividual coexistence and interplay of entrepreneurial passion and passions for non-entrepreneurial roles. In this paper, we specifically focus on the nascent stages of the entrepreneurial process and investigate the role of organization members’ “passion orchestra” in the development of different types of entrepreneurial intentions in a particularly relevant context, namely academia.

We test our conceptual model using survey data from 2308 (post-)doctoral researchers across 24 universities in five European countries. Our empirical analyses reveal that entrepreneurial passion is positively related to spin-off and start-up intentions,

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both directly and indirectly through entrepreneurial self-efficacy. We further theorize and find that researchers with high levels of obsessive scientific passion develop greater intentions to engage in spin-off creation, and lower start-up intentions. This relationship is mediated by individuals' affective organizational commitment. Finally, central to our exploration of the "passion orchestra", our results confirm the interplay between the two passion types. Specifically, we demonstrate that the link between entrepreneurial passion and spin-off intentions is stronger if researchers have an obsessive passion for their scientific role.

This article primarily contributes to the burgeoning literature on passion and entrepreneurship, which we advance in several ways. First, our work challenges extant research that largely assumes that entrepreneurs are motivated by a singular entrepreneurial passion. Instead, we argue that individuals are likely to hold multiple congruent or competing passions, connected to actual and/or possible role identities, which simultaneously affect the new venture creation process. Our conceptual development of the "passion orchestra" lays the ground for future research to unravel the notion in other (organizational) contexts characterized by a multiplicity of identities, and to scrutinize its impact on diverse aspects and throughout different stages of the entrepreneurial process. Moreover, we extend passion research by proposing and testing the mechanisms through which an organization member's "passion orchestra" operates. Finally, by studying the "passion orchestra" underlying the formation of entrepreneurial intentions, we offer better insights into the microfoundations of entrepreneurial transitions (i.e. leaving one organization to found another). Implications for practitioners consist of being aware that individuals' obsessive passions for non-entrepreneurial roles can positively affect the new venture creation process.

## 2. Introduction

An emergent body of entrepreneurship literature indicates that passion plays a critical role in new venture creation processes and outcomes (Cardon et al., 2005; Smilor, 1997). It is the "fire of desire" that fuels entrepreneurs' daily efforts and creativity (Baum et al., 2001; Cardon et al., 2009), and urges them to persist even in the face of challenge and adversity (Cardon et al., 2005; Cardon and Kirk, 2015; Chandler and Jansen, 1992). Further, entrepreneurial passion is instrumental in the entrepreneurial process as it exerts a positive influence on important resource providers, such as investors and employees (Breugst et al., 2012; Chen et al., 2009; Mitteness et al., 2012; Sudek, 2006). Prior research emphasizes that role identity is a vital component of and the central force behind entrepreneurs' passion, driving entrepreneurial actions (Chen et al., 2015). In particular, Cardon et al. (2009, 2013) explicitly incorporate identities in their proposed definition of entrepreneurial passion, thereby distinguishing between the roles of inventor, founder and developer, along with the passion associated with each of these role identities. Murnieks et al. (2014) subsequently demonstrate a strong positive link between the centrality of an entrepreneurial identity and entrepreneurial passion.

Despite significant progress made toward understanding the nature and impact of entrepreneurial passion, current theoretical and empirical work assumes that individuals experience a singular entrepreneurial passion that motivates them to think and act like an entrepreneur. Yet, a parallel emerging research stream on identity in entrepreneurship indicates that, alongside the entrepreneurial identity, meaningful non-entrepreneurial identities are likely to affect individuals' entrepreneurial endeavors and venture decisions (e.g., Jain et al., 2009; Powell and Baker, 2014; Shepherd and Haynie, 2009b; Wry and York, 2015). The ferment generated by such work suggests that (potential) entrepreneurs often simultaneously experience a passion for non-entrepreneurial roles. However, to date, the growing literature on passion in entrepreneurship has ignored that non-entrepreneurial passions may also affect the entrepreneurial process. Consequently, one of the critical questions left unanswered is how entrepreneurial passion shapes new venture creation processes when no longer studied in isolation but in chorus with other relevant types of passion (Cardon et al., 2013).

Our study seeks to fill this gap in the literature and suggests that the impact of entrepreneurial passion may be more complex than previously conceived. Specifically, building upon the tenets of identity theory (Stets and Burke, 2000; Stryker and Burke, 2000), we introduce the concept of a "passion orchestra", i.e. the intraindividual coexistence and interplay of entrepreneurial passion and passions for other non-entrepreneurial roles. In scrutinizing the influence of the "passion orchestra", we focus on the nascent stages of the entrepreneurial process. In particular, we study organization members' entrepreneurial intentions, as they form the first in a series of actions to organizational founding (Bird, 1988). Given the strong connection between entrepreneurial intentions and behavior (e.g., Lee et al., 2011; Obschonka et al., 2010), intentions have become a vibrant field in entrepreneurship research (Fayolle and Liñán, 2014). To date, however, no scholarly attention has been given to the role of passion(s) in shaping individuals' intentions to engage in entrepreneurial activities whilst being part of an established organization. This is surprising since, in the vast majority of cases, the intent to found a new venture originates while a person is employed by an existing organization (Sørensen and Fassiotto, 2011). Moreover, the multiplicity of role identities is undeniably applicable in work organizations (Ashforth, 2000; Dobrev and Barnett, 2005), and the transition to entrepreneurship requires individuals to shift to a new role and to ultimately abandon their current work role (Carroll and Mosakowski, 1987; Hoang and Gimeno, 2010). Hence, it is likely for passion related to one's (possible) entrepreneurial role identity and passion related to one's (actual) work role identity to come together and interact. Accordingly, our paper disentangles how organization members' "passion orchestra" is related to the formation of entrepreneurial intentions. Furthermore, since little is known about the mechanisms through which passion operates (Cardon et al., 2013; Murnieks et al., 2014), we identify and investigate the impact of two mediating mechanisms, namely a person's entrepreneurial self-efficacy beliefs and affective commitment toward his or her current work organization.

In this paper we embed our theorizing in the context of academia, as entrepreneurship out of universities is increasingly important (Ambos et al., 2008; Etzkowitz, 2003; Jain et al., 2009). Specifically, we unravel how researchers' passion related to

their entrepreneurial identities (i.e. entrepreneurial passion), passion related to their scientific identities (i.e. scientific passion), and the interplay between both passions (i.e. the “passion orchestra”) are associated with entrepreneurial intentions. Moreover, we acknowledge that academics may hold different types of entrepreneurial intentions. While one researcher may specifically intend to spin off a firm initiated within a university setting and based upon scientific results (Rasmussen and Borch, 2010; Steffensen et al., 2000), another may develop general entrepreneurial intentions and aspire to found any type of company, for instance a new venture detached from his or her academic research.

This article contributes to two distinct literatures. First, we advance theory and empirical research on *passion and entrepreneurship* by showing how a combination of different types of passion, as opposed to an individual's passion for entrepreneurial roles exclusively, affects the new venture creation process. We argue that, especially in an organizational context, multiple passions function and interact in the form of a “passion orchestra.” As such, unraveling this “passion orchestra” results in a better and more fine-grained understanding of the formation of entrepreneurial intentions out of work organizations. By doing this, our work provides a conceptual basis for additional research on how entrepreneurial passion manifests itself in other situations where individuals are likely to hold multiple role identities and passions (e.g., in social ventures or family businesses). Additionally, our study is novel in proposing and testing potential mechanisms through which different types of passion affect entrepreneurial intentions. In that way, we respond to a call by Cardon et al. (2013) to examine the influence of entrepreneurial passion, both uniquely and along with other cognitive and affective dimensions.

Second, this study enriches the *academic entrepreneurship literature* in a number of ways. Specifically, while prior research points to the importance of researchers' personal networks, perceived role models, academic experience and engagement in applied research (Prodan and Drnovsek, 2010), as well as attitudes, perceived control, social norms and group identification (Goethner et al., 2012; Obschonka et al., 2012; Sieger and Monsen, 2015) for entrepreneurial intentions in academia, we complement existing research by identifying multiple passion(s) as motives behind academic entrepreneurship. Further, our distinction between spin-off and start-up intentions is important, particularly for universities and technology transfer managers because spin-off portfolios can generate income via equity positions or reputational benefits (Pitsakis et al., 2015), thus responding to policy makers' pressure to increase national competitiveness through academic research commercialization (Ambos et al., 2008). As such, understanding which and how different types of passion are related to intentions to found a firm based upon university research (i.e. spin-off intentions) and intentions to found any type of company (i.e. start-up intentions) is relevant from a practical perspective. From a theoretical point of view, university spin-offs are studied extensively (Djokovic and Souitaris, 2008; Wright et al., 2008) and different spin-off typologies are suggested (e.g., Druilhe and Garnsey, 2004; Nicolaou and Birley, 2003; Steffensen et al., 2000), but prior research largely neglects acknowledging that some researchers may intend to engage in entrepreneurial activities that are not related to their research (an exception is the study by Lee and Wong (2004)).

In summary, while prior research focuses on the substance and sole impact of entrepreneurial passion, we aim to provide a more holistic picture by studying the “passion orchestra” and its effect on different types of entrepreneurial intentions in a particularly relevant organizational context, namely academia. Our theoretical model is tested using survey data from 2308 researchers working at 24 universities in five European countries.

### **3. Theoretical foundations**

#### *3.1. Work passion and entrepreneurial passion*

Initially, passion was defined as “a strong inclination toward an activity that people like, find important, and in which they invest significant time and energy” (Vallerand et al., 2003: 756). Passion is a motivational construct and a domain-specific notion; i.e. the target is a specific role, object or activity that depicts certain values (Chen et al., 2009; Murnieks et al., 2014). Additionally, and importantly, in order to be passionate, this target must be internalized into one's self-identity (Vallerand et al., 2003, 2007). The dualistic model by Vallerand et al. (2003) further posits that, dependent on the type of internalization process taking place, obsessive or harmonious passion can emerge. Harmonious passion is the result of a role or activity that has been internalized autonomously into the individual's identity; i.e. the person sees the role or activity as being inherently important without any attached contingencies. By contrast, obsessive passion is formed when the role or activity is internalized in such a way that it controls the individual's identity.

Passion is the focus of a large body of research in social psychology. The concept is studied in diverse life domains including passion for one's work or job (e.g., Boyatzis et al., 2002; Wong and Lee, 2011; Klapmeier, 2007). Extant literature associates work passion with both positive and negative cognitive, affective, and behavioral outcomes. Furthermore, work passion is found to influence personal characteristics, such as mental well-being (Burke and Fiskinbaum, 2009; Vallerand and Houlfort, 2003), alongside desirable behaviors for the organization, including productivity (Zigarmi et al., 2009), commitment (Forest et al., 2011) and work performance (Wong and Lee, 2011).

Even though passion has always been at the heart of entrepreneurship (Cardon et al., 2005), the notion of entrepreneurial passion is subject to renewed scholarly attention. Bird (1989: 7-8) already indicated that “entrepreneurial behavior is passionate, full of emotional energy, drive, and spirit.” Similarly, Smilor (1997: 342) noted that passion is “perhaps the most observed phenomenon of the entrepreneurial process.” A theoretical conceptualization was only introduced by Cardon et al. (2009), who defined entrepreneurial passion as consciously accessible, intense positive feelings toward entrepreneurial tasks and activities, associated with roles that are meaningful and salient to one's self-identity. Further, Cardon et al. (2009) call attention to the multifaceted nature of entrepreneurial passion, putting forward three distinct role identities based on different aspects of the entrepreneurial

process: (1) an inventor identity where the passion is for activities involved in identifying, inventing and exploring new opportunities; (2) a founder identity, where the passion is for activities involved in establishing a venture for commercializing and exploiting opportunities; and (3) a developer identity, where the passion is for activities related to nurturing, growing, and expanding the venture after its founding. These different identity-related passions affect goal-related cognitions and propel specific entrepreneurial outcomes (Cardon et al., 2009).

Thus, entrepreneurial passion, acting through its components of intense positive feelings tied to salient identities, is a key motivational driver of entrepreneurial behavior (Cardon et al., 2009; Murnieks et al., 2014). Recent empirical studies demonstrated the value of passion for entrepreneurial self-efficacy, vision and goals (Baum and Locke, 2004; Murnieks et al., 2014), creativity and persistence (Cardon and Kirk, 2015; Cardon et al., 2013), recruitment and motivation of employees (Breugst et al., 2012; Cardon, 2008), funding success (Chen et al., 2009; Mitteness et al., 2012; Sudek, 2006), financial performance (Ho and Pollack, 2014), and new venture growth (Baum et al., 1998, 2001; Baum and Locke, 2004).

Our study builds upon an integration of the work of Vallerand et al. (2003, 2007) with that of Cardon et al. (2005, 2009). While the two research streams have evolved in relative isolation, their theorizing provides the foundation to unravel the impact of organization members' "passion orchestra", i.e. entrepreneurial passion and work passion coming together in a person. Despite variation in definition, considerable overlap exists in that they both stipulate that passion entails an affective dimension, namely strong positive emotions directed toward something meaningful to the individual. In addition, an important commonality between the two approaches is that identities are crucial components of passion, as they represent a powerful motivational impulse underlying actions (Chen et al., 2015; Murnieks et al., 2014). Given the centrality of identity in entrepreneurial transitions (Farmer et al., 2011; Hoang and Gimeno, 2010; Obschonka et al., 2015), we elaborate on identity theory before turning to the development of our conceptual model.

### 3.2. Identity theory

Identity theory, with its roots in social psychology, casts roles and identities as the basis of an individual's self-concept, which develops from childhood over the lifespan and provides a sense of individuality, meaning and orientation in life (Hogg et al., 1995; Stets and Burke, 2000; Stryker and Burke, 2000). Roles are positions in society (e.g., parent, doctor, employee, or entrepreneur) that reflect a set of expectations for goal-oriented actions (Callero, 1985; Stets and Burke, 2000). Identities are cognitive schemas that emerge from reflection on, and identification with, societal roles that a person occupies or wishes to occupy (Stets and Burke, 2000; Stryker and Burke, 2000). The core of an identity is the internalization of external behavioral expectations associated with a role into the self-concept (Stets and Burke, 2000; Stryker, 1968; Thoits, 1986). The more one perceives oneself as congruent with role meanings and standards, the more likely one will assume that role (Gecas, 1982).

Hence, role identities guide decisions and actions (Burke, 1991; Cast, 2004; Stets and Burke, 2000) as individuals are strongly motivated to behave in a manner consistent with their identities (Burke and Reitzes, 1981; McCall and Simmons, 1978). By achieving such an identity-behavior fit, people confirm and support their self-concept (Stets and Burke, 2000) and avoid cognitive dissonances (Festinger, 1957). Furthermore, individuals possess not just one but a collection of role identities (Stryker, 1968; Stryker and Burke, 2000). These multiple identities within one's self-concept are organized hierarchically such that an identity situated higher in the hierarchy is more salient, and more likely to be enacted and to generate intense positive emotions than those placed lower (Callero, 1985; Murnieks and Mosakowski, 2006; Stryker, 2004; Stryker and Serpe, 1994). Moreover, multiple role identities can come together in directing an individual's actions, thereby enhancing or impeding one another (Ashforth, 2000; Stryker and Burke, 2000).

Importantly, identity theory further argues that the self-concept is future-oriented in that it seeks validation for a role one hopes to take (Hoyle and Sherrill, 2006; Stryker, 1980). Consequently, several studies demonstrate that individuals hold possible (future or hoped-for) identities, which have the same properties as actual (current) identities (e.g., Ibarra, 1999; Markus and Nurius, 1986; Strauss et al., 2012). As part of one's self-concept, possible identities also guide and motivate goal-oriented behavior, often to the extent that a possible role will become an actual one (Hoang and Gimeno, 2010; Ibarra, 1999; Markus and Nurius, 1986). Due to their domain-specificity, salient possible identities affect behavior in the area of individuals' lives to which they are related. Possible identities are shown to help structure and facilitate career transitions in general (Ashforth, 2000; Ibarra, 1999; Strauss et al., 2012) and the shift toward entrepreneurship (Hoang and Gimeno, 2010) or academic entrepreneurship (Jain et al., 2009) in particular.

Drawing on these theoretical considerations, we contend that a person can possess multiple passions, connected to actual and/or possible role identities, which can either reinforce or work against each other (dependent on complementary or competing nature of the identities).

## 4. Hypotheses development

In what follows, we build upon extant passion literature and identity theory to investigate how researchers' "passion orchestra" relates to their intentions to engage in spin-off and start-up creation. In studying entrepreneurial passion as first part of the "passion orchestra," we concentrate on passion for inventing. This is consistent with Cardon et al.'s (2013) recommendation to consider the domains of entrepreneurial passion (i.e. inventing, founding, and developing) separately, as each fit a specific research question. Our emphasis on passion for inventing, or pre-founding activities related to opportunity recognition (Cardon et al., 2009), is warranted as entrepreneurial intentions are formed early on in the entrepreneurial process (Bird, 1988; Krueger

et al., 2000; Lee et al., 2011). As the second part of researchers' "passion orchestra", we study obsessive scientific passion. This responds to a call by Chen et al. (2015) to take the occupational context into consideration when conceptualizing passion for one's work. Moreover, in line with our identity-based theoretical underpinnings, we focus on Vallerand et al. (2003)'s obsessive passion type. Compared to harmonious passion, obsessive passion takes a more central role in an individual's identity. Specifically, for harmoniously passionate individuals, the role or activity does not overpower their lives, but rather remains in balance with other aspects and activities (Vallerand et al., 2003). In contrast, obsessive passion represents an internal and uncontrollable pressure forcing one to engage in a particular role or activity, which then takes disproportionate space in a person's identity (Vallerand et al., 2003). As a result, for obsessively passionate individuals, the role or activity may lead to the neglect of (Mageau et al., 2005), or conflict with (Vallerand et al., 2003), other aspects of their life. Since our conceptualization of the "passion orchestra" is grounded in identity theory and aims to understand the interplay between multiple passions, it is most relevant to consider an obsessive passion for one's work. Indeed, by exploring researchers' obsessive scientific passion combined with entrepreneurial passion, we concentrate on passion types that are likely to either hinder or strengthen each other.

Furthermore, to understand the mechanisms through which the different types of passion affect entrepreneurial intentions, our model includes the indirect paths through which entrepreneurial passion and obsessive scientific passion affect such intentions. In particular, scholars have urged viewing passion as a trait-like characteristic that exerts an influence on the entrepreneurial process via more proximal and situation-specific motivational factors (Baum and Locke, 2004; Shane et al., 2003). Therefore, our model incorporates two mediating mechanisms that have received a great deal of attention as dominant motivational drivers of entrepreneurial intentions, or turnover intentions in organizations, and are simultaneously linked with passion through its identity and/or affective components; namely entrepreneurial self-efficacy and affective organizational commitment. Fig. 1 summarizes the theoretical model we outline below.

#### 4.1. Researchers' entrepreneurial passion and entrepreneurial intentions

Since new venture creation processes mostly commence whilst the (future) entrepreneur is a paid employee (Dobrev and Barnett, 2005; Sørensen and Fassiotto, 2011), the working population in established organizations can be understood as the primary source of entrepreneurs. Thus, a significant proportion of the members of any work organization can be expected to foster a passion for entrepreneurship. This is particularly true in an academic context, as the rise of the entrepreneurial university requires researchers to simultaneously take on several roles, and in particular to balance knowledge generation and knowledge transfer (Ambos et al., 2008; Etzkowitz, 2003). Subsequently, researchers are increasingly expected to broaden their repertoire of role identities (Jain et al., 2009; Lam, 2010; Owen-Smith and Powell, 2004). In addition to their "traditional" (actual) scientific identity, they are likely to include a "new" (possible) entrepreneurial identity as a prominent part of their self-concept. Given that researchers differ in terms of their entrepreneurial identities (Obschonka et al., 2015), it is plausible to assume heterogeneity in their passion associated with entrepreneurial identities.

Consistent with identity theory and Cardon et al.'s (2009) conceptualization, we expect that the experience of entrepreneurial passion will trigger researchers' pursuit of self-supporting goals, i.e. motivate them to act in accordance with their underlying entrepreneurial identities. This is because, as articulated above, individuals seek to validate their self-concept through cognitive and behavioral engagement in identity-relevant activities (Hogg et al., 1995; Stets and Burke, 2000). Put differently, researchers' (possible) entrepreneurial identities will guide and motivate behavior toward the entrepreneurial role. The formation of entrepreneurial intentions then constitutes an early, yet necessary step in the process toward the adoption of this role (Crant, 1996). Consequently, we assume that researchers with greater levels of entrepreneurial passion will have stronger entrepreneurial

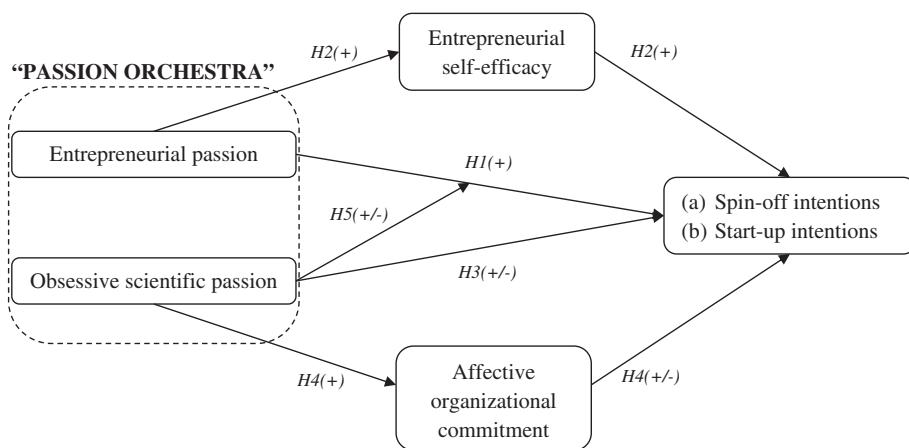


Fig. 1. Conceptual model.

intentions. This logic holds for the two types of intentions investigated in this study as both spin-off and start-up creation represent an expression of one's entrepreneurial identity and passion. Thus, we propose:

**Hypothesis 1a.** : Entrepreneurial passion is positively related to spin-off intentions.

**Hypothesis 1b.** : Entrepreneurial passion is positively related to start-up intentions.

In addition to the direct impact of entrepreneurial passion on both spin-off and start-up intentions, we expect the presence of entrepreneurial passion to also indirectly affect entrepreneurial intentions through a closer key antecedent, namely entrepreneurial self-efficacy. Entrepreneurial self-efficacy refers to an individual's self-confidence in his or her ability to successfully perform entrepreneurial roles and tasks (Chen et al., 1998; Zhao et al., 2005). Although entrepreneurial passion and entrepreneurial self-efficacy both underline the importance of engaging in activities that are meaningful for one's self-identity (Bandura, 1997; Vignoles et al., 2006), these are two distinct constructs (Cardon et al., 2009; 2013).

In particular, individuals who are passionate about an activity are more likely to develop their skills at it, which not only increase their ability to perform the activity but also augments their self-efficacy beliefs (Baum and Locke, 2004). Organization members who experience passion associated with a (possible) entrepreneurial identity will seek to advance skills relevant for the pre-founding stage they are in. Those potential entrepreneurs can for instance develop their opportunity recognition skills through entrepreneurship courses and training. Indeed, several scholars have indicated that, in the early stages of the entrepreneurial process, targeted education can play an important role in developing self-efficacy (Krueger and Brazeal, 1994; Wilson et al., 2007). Specifically, as participants in entrepreneurship education get business exercises, are confronted with entrepreneurial role models and mentors, they are likely to develop higher levels of entrepreneurial self-efficacy (Zhao et al., 2005).

Additionally, individuals make judgments about anticipated task abilities and performance based on how positively or negatively aroused they feel with respect to that particular task (Bandura, 1988). The extent to which people experience feelings of joy for a certain task also stimulates them to focus on the retrieval of task-relevant knowledge (Foo et al., 2009). Therefore, positive arousal and feelings associated with a particular role or activity, which are inherent in passion (Cardon et al., 2009), can boost an individual's perceived self-efficacy or confidence to succeed in that role or activity (Murnieks et al., 2014). Following these arguments, we expect a positive relation between entrepreneurial passion and entrepreneurial self-efficacy.

In turn, entrepreneurial self-efficacy is consistently shown to enhance entrepreneurial intentions (Boyd and Vozikis, 1994; Chen et al., 1998; Krueger, 1993; Zhao et al., 2005). Researchers who feel confident that they have the requisite entrepreneurial capabilities are more likely to aspire to the founding of either a spin-off or start-up. As such, self-efficacy is likely a proximal predictor of entrepreneurial intentions, while passion is a more distant antecedent. Accordingly, we expect an indirect relationship between entrepreneurial passion and intentions through entrepreneurial self-efficacy. Hence, we propose that:

**Hypothesis 2a.** : The positive relationship between entrepreneurial passion and spin-off intentions is mediated by entrepreneurial self-efficacy.

**Hypothesis 2b.** : The positive relationship between entrepreneurial passion and start-up intentions is mediated by entrepreneurial self-efficacy.

#### 4.2. Researchers' obsessive scientific passion and entrepreneurial intentions

Given the influence of multiple identities throughout the new venture creation process (Powell and Baker, 2014), it is likely that passion related to non-entrepreneurial identities also shapes the formation of entrepreneurial intentions. Specifically, as organization members, individuals often experience a passion related to their (current) work role or activities (Boyatzis et al., 2002; Wong and Lee, 2011). In academia, notwithstanding the institutional transformation and the emergence of a "new" (possible) entrepreneurial identity, university researchers still assume their "traditional" (actual) scientific identity, investing significant time and energy in research activities (Jain et al., 2009; Lam, 2010). Research institutions such as universities and the individuals working for these organizations are strongly pressured to produce new scientific knowledge of high quantity and quality, resulting in a "publish-or-perish" culture (Miller et al., 2011). Then again, given the hierarchical organization of individuals' multiple identities (Stryker and Serpe, 1994), not all researchers will accord equal importance to their scientific identity, evoking different degrees of passion (Murnieks et al., 2014).

Since individuals make decisions in accordance with their underlying identities (Burke and Reitzes, 1981), we expect researchers' obsessive scientific passion to be associated with entrepreneurial intentions, but differently with respect to spin-off and start-up intentions. Fundamentally, in order to maintain and confirm their self-concept, individuals strive for identity relevance and consonance in their behaviors (Hogg et al., 1995; Stets and Burke, 2000). Identities provide direction and impetus for action; they motivate a person to undertake certain activities and to disengage from others (Burke and Reitzes, 1991; Cardon et al., 2009), which is our rationale to theorize opposite effects for spin-off and start-up intentions.

First, as far as intentions to establish a university spin-off are concerned, engagement in such entrepreneurial endeavor is relevant for researchers attaching high importance to their scientific role identity as spin-offs are companies based upon scientific research results (Rasmussen and Borch, 2010; Steffensen et al., 2000). Indeed, spin-offs usually exploit ideas or technologies developed within the parent university that are radically new, disruptive and early stage (Christensen, 2003; Danneels, 2004).

Given that individuals search for engagement in activities that conform with their identities (Burke and Reitzes, 1981; McCall and Simmons, 1978) and that spin-offs are essentially formed around specific scientific knowledge that is embodied in academics (Clarysse et al., 2007), we argue that researchers who are highly passionate about their scientific role will show a greater propensity to enact their scientific passion through spin-off creation. Second, with regard to intentions to found a start-up company, it is unlikely that researchers searching to fuel their scientific identity will have intentions to set up a venture that is not necessarily linked to their scientific research. This is because when behaviors lack congruence with or distract from one's identities, individuals seek disengagement and such activities will be avoided (Burke and Reitzes, 1991; Cardon et al., 2009). Usually, the foundation of a start-up, in contrast to a university spin-off, is associated with the investment and reallocation of time and effort into activities that are not necessarily related to the researcher's scientific role identity. Hence, researchers with high levels of obsessive scientific passion might view engagement in a start-up as a disturbance from, or obstacle to, the scientific research activities they are obsessively passionate about. Following an identity-based logic, a mismatch exists between the researchers' self-concept tied to their scientific role and the propensity to found any type of company. Consequently, we expect a negative relation between obsessive scientific passion and start-up intentions. In summary, because individuals have a strong need for identity-consistent actions, we postulate that researchers with high levels of obsessive scientific passion hold greater intentions to found a university spin-off, but lower intentions to establish a start-up. Thus:

**Hypothesis 3a.** : Obsessive scientific passion is positively related to spin-off intentions.

**Hypothesis 3b.** : Obsessive scientific passion is negatively related to start-up intentions.

In addition to this direct relationship, we propose that obsessive scientific passion operates through a more proximal antecedent of entrepreneurial intentions, namely affective commitment or emotional attachment to one's organization (e.g. Cropanzano et al., 1993; Meyer and Allen, 1991; Mowday et al., 1979). Such commitment denotes "the relative strength of an individual's identification with and involvement in a particular organization" (Mowday et al., 1979: 226) and manifests "his or her willingness to give energy and loyalty to the organization" (Kanter, 1968: 499). In an organizational context, passion and affective commitment are both motivational constructs with emotional underpinnings, but they are distinguished on the basis of specificity and attitudinal referent (Wong and Lee, 2011). Specifically, the former pertains to an affective state related to one's work role or activities, where the latter is directed toward the work organization. Even so, we can expect a positive relation between both constructs.

Passionate individuals experience a strong liking for a particular role or activity (Vallerand et al., 2003). As a result, organization members with work passion exhibit high levels of work engagement (Astakhova and Porter, 2015), and invest considerable resources in their work role and activities. Because work is generally contained within the organizational setting, organizational life becomes a central part of an individual's life, cultivating his or her identification with and involvement in the organization (Kong, 2016; Mageau et al., 2009; Vallerand and Houlfort, 2003). Since individuals seek opportunities to express their identities and value environments that facilitate this self-expression (Ashforth, 2000), passionate employees are prepared to give increased amounts of energy to the organization that enables them to carry out their meaningful work role (Forest et al., 2011).

The affect infusion model further suggests that organization members' affect influences their evaluations of, and attitudes toward their work environment (Forgas and George, 2001; Thoresen et al., 2003). Individuals with obsessive passion are likely to experience reduced positive affect (or even negative affect) when they are prevented from engaging in the activity (Mageau and Vallerand, 2007; Philippe et al., 2010). This is because a role that one is obsessively passionate about entails a high-priority status in people's goals hierarchy (Carver, 1996), which results in a tendency to value this role above all others and to rigidly persist in pursuing that role (Vallerand et al., 2003; Carpentier et al., 2012). With the production of scientific knowledge as primary objective (Ambos et al., 2008; Jain et al., 2009), universities act as facilitator for engagement in the activities the individual is so passionate about, as such preventing the origin of negative affect, and fueling his or her affective commitment toward the university. Accordingly, we expect researchers with an obsessive passion for their scientific role to be more emotionally attached to the university that allows them to live out that passion.

Consecutively, affective organizational commitment captures members' willingness to invest knowledge and effort in achieving organizational goals (Allen and Meyer, 1990; O'Reilly and Chatman, 1986). Put differently, affective commitment not only represents members' positive feelings about their involvement in the organization, but also their expressed sentiments of loyalty and their desire to help the organization be successful (Foreman and Whetten, 2002) and competitive (Katz and Kahn, 1978). Driven by their attachment to and identification with their employer, employees will behave in ways that benefit their work organization (Meyer and Allen, 1997; Meyer and Herscovitch, 2001).

By dedicating time and energy to the establishment of spin-off companies, committed researchers can help their parent universities to fulfill their "third mission," related to research commercialization and economic development (Etzkowitz, 2003). Therefore, we predict a positive relationship between affective organizational commitment and spin-off intentions. In contrast, in the case of start-up intentions, we hypothesize a negative association as the emotional binding of a researcher to the university is likely to discourage him or her to found a new venture that is not necessarily an extension of his or her scientific work. This is because engaging in a start-up might distract those committed individuals from carrying out activities that would help the university move ahead. Additionally, universities typically remain highly involved in their spin-off firms after foundation, for instance as a shareholder or through board representation (Feldman et al., 2002; Siegel et al., 2003; Smilor et al., 1990; Vohora et al., 2004). Further, universities keep strong ties with their spin-off companies by providing tangible resources, including laboratory

facilities and access to research equipment (Steffensen et al., 2000), as well as intangible resources, such as intellectual property rights (Rappert et al., 1999). In other words, in contrast to start-up creation, the establishment of a spin-off inevitably involves intensive interaction with the parent institution, both during pre- and post-formation stages (Wright et al., 2006), which calls for some level of devotion. Subsequently, we assume affective organizational commitment to be a mediator between obsessive scientific passion and entrepreneurial intentions. Specifically, we expect a positive relationship between obsessive scientific passion and affective organizational commitment, just as a positive association affective commitment and spin-off intentions, but a negative link between commitment and start-up intentions. Hence:

**Hypothesis 4a.** : The positive relationship between obsessive scientific passion and spin-off intentions is mediated by affective organizational commitment.

**Hypothesis 4b.** : The negative relationship between obsessive scientific passion and start-up intentions is mediated by affective organizational commitment.

#### 4.3. Researchers' "passion orchestra" and entrepreneurial intentions

Finally, we contend that the individual's "passion orchestra" and, thus, the interplay between multiple passions within the person will shape his or her entrepreneurial intentions in a characteristic way that would not be detectable if one only looked at the isolated effects of individual passion types. Given that multiple role identities may be reinforcing or conflicting (Ashforth, 2000; Stryker and Burke, 2000), we expect that this also applies to the nature of multiple passions. Specifically, we predict that the association between entrepreneurial passion and intentions, as stated in [Hypotheses 1a and 1b](#), will be contingent on researchers' levels of obsessive scientific passion, and that spin-off and start-up intentions are affected differently.

On the one hand, university spin-offs are a combination of two key determinants, namely a strong scientific base and an entrepreneurial mindset (Roberts, 1991). As spin-off creation allows researchers to fuse their dual role identities – what individuals typically strive for (Cast and Burke, 2002) – by simultaneously pursuing their entrepreneurial and scientific passions, we put forward obsessive scientific passion as an amplifier in the positive association between entrepreneurial passion and spin-off intentions. In other words, supporting one identity does not constrain one's ability to behave in accordance with others. Researchers who possess entrepreneurial passion and are also obsessively passionate about scientific research will exhibit greater intentions to create university spin-offs. On the other hand, we propose obsessive scientific passion to weaken the positive association between entrepreneurial passion and start-up intentions. Where passion tied to a highly salient entrepreneurial identity is vital for start-up intentions to develop (as stated in [Hypothesis 1b](#)), it is likely that having another salient identity and related passion may interfere with this process, particularly if the other identity is not required for, or even conflicting with, the role or activity pursued (Stryker and Burke, 2000). In contrast to spin-off intentions, which call for the integration of complementary multiple identities and passions, researchers' scientific identity is not instrumental in the formation of start-up intentions. Particularly, following insights on identity conflict (Shepherd and Haynie, 2009a, 2009b; Stryker and Burke, 2000), enacting a scientific role identity entails activities that are inherently different from the founding of any type of business, and may constrain individuals' ability to behave in accordance with their entrepreneurial role identity. Consequently, due to this discrepancy, high levels of obsessive scientific passion could hinder researchers from following their entrepreneurial passion. Taken together, we expect among researchers with a strong entrepreneurial passion, those who also report an obsessive passion for scientific research to possess greater intentions to create a spin-off but lower start-up intentions. Hence:

**Hypothesis 5a.** : Obsessive scientific passion strengthens the positive relationship between entrepreneurial passion and spin-off intentions.

**Hypothesis 5b.** : Obsessive scientific passion weakens the positive relationship between entrepreneurial passion and start-up intentions.

### 5. Methodology

#### 5.1. Data collection and sample

Our study is based upon cross-sectional data collected in 2012 and 2013 at 24 universities in five European countries. The clusters proposed by the Global Leadership and Organizational Behavior Effectiveness research program (GLOBE) were used as starting point for our country selection (Gupta et al., 2002). GLOBE builds upon nine cultural dimensions to capture (dis)similarities in norms, values and beliefs for the construction of societal clusters (Javidan et al., 2006). Given our aim to produce cross-cultural insights and to generalize our findings across Europe, we selected countries belonging to different clusters. The selection of the following countries within each cluster was random: Sweden (Nordic Europe), Spain (Latin Europe), Slovenia (Eastern Europe), Germany and Belgium (German-speaking and Dutch-speaking Germanic Europe). A noteworthy difference at country level lies in the academic exemption or professor's privilege in Sweden, which asserts full ownership of intellectual property rights to the faculty members (Klofsten and Jones-Evans, 2000). Within each country, we randomly selected two level-1 NUTS

regions: East Sweden (SE1) and South Sweden (SE2), Community of Madrid (ES3) and East Spain (ES5), Slovenia (S10),<sup>1</sup> Bavaria (DE2) and North Rhine-Westphalia (DEA), Brussels Capital (BE1) and Flanders (BE2). Next, we compiled a list of all universities in those geographical regions using secondary sources (including reports by ministries of education, university rankings, technology transfer networks and general internet searches). A total of 58 universities were contacted through emailing their technology transfer offices (TTOs), asking for their participation in our research. In case of non-response over e-mail, TTOs were contacted by telephone. Eventually, we received positive answers from 40 TTOs.

Subsequently, we arranged face-to-face interviews with the TTOs, at which time nine TTOs were not available or unwilling to participate, resulting in 31 TTOs offering full collaboration. Through these interviews, we obtained information on university characteristics (e.g., human and financial resources, annual innovation output) and technology transfer practices (e.g., history and organizational structure). Primary data were verified and complemented with secondary data from annual reports, university and TTO websites. Furthermore, we asked for permission and assistance in order to contact and send individual researchers from different disciplines a survey; this was infeasible at seven universities due to privacy rules or the nonexistence of staff directories. Our survey specifically targeted (junior, untenured) researchers, i.e. pre- and post-docs, as opposed to (senior, tenured) professors for multiple reasons. First, while a great deal is written about the entrepreneurial role of professors (e.g., Etzkowitz, 2003; Lam, 2010), surprisingly little is known about the growing number of (post-)doctoral researchers who produce a substantial share of university knowledge (Enders, 2002), while also contributing to professors' scientific and technical human capital (Bozeman and Corley, 2004). Moreover, researchers constitute an important channel for knowledge transfer because of their frequent interactions with industry (Bienkowska and Klofsten, 2012; Thune, 2009). Second, (post-)doctoral researchers are more likely to expand their capabilities due to uncertainty about which career path will be the most favorable to them in the future (Krabel and Mueller, 2009), while professors may simply lack the skills and abilities needed to pursue commercial outputs (Lockett et al., 2003; Shane, 2002). Finally, (post-)doctoral researchers deserve closer scrutiny because they represent the new generation of academics that will shape universities in the future.

The survey population consisted of 32,358 researchers. Respondents received a request through email to complete an online questionnaire, followed by a kind reminder one week later. We received 6442 failure messages indicating that email addresses were either invalid or that our message could not be sent, resulting in a usable population of 25,916 researchers. In total, 4515 responses were received (or 17% of the usable population, which is comparable to previous research in this domain). After eliminating incomplete responses, our final sample consists of 2308 researchers who fully completed the questionnaire, or 9% of the usable population. T-tests revealed no significant differences between respondents who filled in all questions and those who provided incomplete responses, or between early and late respondents, in terms of age, gender, education, experience, discipline or country ( $p > 0.05$ ). Some *ex ante* procedural techniques were applied during the data collection process to reduce the risk of common method bias (CMB). In our email, we guaranteed anonymity to reduce respondents' tendency to give socially desirable answers (Podsakoff et al., 2003). Moreover, careful attention was given to the wording of questions in order to avoid vague concepts and to reduce items' ambiguity (Tourangeau et al., 2000). Furthermore, as we explain below, we used the unmeasured latent method construct (ULMC) procedure to verify that CMB is unlikely to affect our results.

## 5.2. Measures

### 5.2.1. Dependent variables

*Spin-off intentions* were measured through the following three items, based upon Krueger et al. (2000)'s scale for entrepreneurial intentions and the definition of university spin-offs (Rasmussen and Borch, 2010; Steffensen et al., 2000). Three questions were asked: "How likely is it that, in the foreseeable future, (1) You Will engage in the founding of a university spin-off?; (2) You will engage in the establishment of a company based upon an idea and/or technology developed at the university?; and (3) You will participate in the founding of a firm to commercialize your research?", on a scale ranging from 1 (very unlikely) to 7 (very likely). Cronbach's alpha is 0.92, indicating high scale reliability (Hair et al., 2006).

*Start-up intentions* were captured by asking respondents to respond to two questions, based on Kolvereid (1997): "How likely is it that, in the foreseeable future, (1) You will pursue a career as entrepreneur?; and (2) You will start your own business?" (1 = very unlikely, 7 = very likely). Scale reliability measured by Cronbach's alpha is 0.85.

Given the centrality of the distinction between spin-off intentions and start-up intentions in our study, principal components analysis (PCA) was used to investigate the underlying structure of the five measurement items. Oblique promax rotation was utilized, which allows the factors to be correlated. This is in line with previous studies that focus on two distinct but not mutually exclusive types of entrepreneurial intentions (e.g., independence-intentions and growth-intentions in Douglas (2013), intrapreneurial and entrepreneurial intentions in Douglas and Fitzsimmons (2013)). As depicted in Table 1, this procedure confirmed the existence of two factors with eigenvalues above 1, which accounted for 86.77% of the cumulative variance. The two factors were identified as spin-off intentions (3 items) and start-up intentions (2 items). In addition to this exploratory factor analysis, we conducted confirmatory factor analyses (CFAs) to demonstrate that the distinction is warranted. The results indicated that the two-factor model ( $\chi^2 = 38.75$ ,  $p < 0.001$ ; comparative fit index [CFI] = 0.99; root mean square of approximation [RMSEA] = 0.06 (90% confidence interval [CI]: 0.05–0.08)) fits the data significantly better than the one-factor model ( $\chi^2 = 1523.30$ ,  $p < 0.001$ ; CFI = 0.80; RMSEA = 0.37 (90% CI: 0.35–0.38); difference in  $\chi^2 = 1484.55$ ,  $df = 1$ ,  $p < 0.001$ ) (Hu and

<sup>1</sup> Slovenia has only one 1st level NUTS region.

**Table 1**

Principal components analysis (with oblique promax rotation).

How likely is it that, in the foreseeable future,	Factor 1 (Spin-off)	Factor 2 (Start-up)
(1) You will engage in the founding of a university spin-off?	<b>0.917</b>	0.358
(2) You will engage in the establishment of a company based upon an idea and/or technology developed at the university?	<b>0.945</b>	0.407
(3) You will participate in the founding of a firm to commercialize your research?	<b>0.921</b>	0.452
(4) You will pursue a career as an entrepreneur?	0.428	<b>0.933</b>
(5) You will start your own business?	0.386	<b>0.937</b>
Proportion of variance	63.77%	23.00%
Cronbach's alpha	0.92	0.85

The first factor 'spin-off intentions' is an amalgam of three items; the second factor 'start-up intentions' is an amalgam of two items (indicated in **bold**).

Bentler, 1999). This again demonstrates that our dependent variables are not only theoretically but also empirically distinguishable.

### 5.2.2. Independent variables

*Entrepreneurial passion* was assessed by Cardon et al. (2013)'s passion for entrepreneurial inventing scale, which incorporates the two dimensions of intense positive feelings and identity centrality.<sup>2</sup> Respondents were asked to indicate their degree of agreement with the following statements on a scale ranging from 1 (strongly disagree) to 7 (strongly agree): "(1) It is exciting to figure out new ways to solve unmet market needs that can be commercialized; (2) Searching for new ideas for products/services to offer is enjoyable to me; (3) I am motivated to figure out how to make existing products/services better; (4) Scanning the environment for new opportunities really excites me; (5) Inventing new solutions to business problems is an important part of who I am; (6) I frequently think about inventing new solutions to business problems; (7) Identifying and developing new business opportunities is central to how I define myself; and (8) I would feel a loss if I were forced to give up searching for new solutions to business problems" (Cronbach's alpha 0.94).

*Obsessive scientific passion* was measured using Vallerand et al. (2003)'s obsessive passion scale. Because the original scale was applied to a generic activity, we adapted this by rewording the items to refer to scientific research activities. The developed items are as follows: "(1) I cannot live without engaging in scientific research; (2) The urge is so strong, I can't help myself from doing scientific research; (3) I have difficulty imagining my life without scientific research; (4) I am emotionally dependent on my engagement in scientific research; (5) I have a tough time controlling my need to engage in scientific research; (6) I have almost an obsessive feeling for scientific research; and (7) My mood depends on me being able to do scientific research." The Cronbach's alpha coefficient for the scale is 0.93.

### 5.2.3. Mediating variables

*Entrepreneurial self-efficacy* was assessed using the scale developed and validated by Zhao et al. (2005), including four items: "How confident are you in successfully 1) Identifying new business opportunities?; 2) Creating new products?; 3) Thinking creatively?; and 4) Commercializing an idea or new development?" (1 = no confidence, 7 = complete confidence). Scale reliability measured by Cronbach's alpha is 0.82.

*Affective organizational commitment* was measured using five items (Cheng et al., 2003; O'Reilly and Chatman, 1986) capturing researchers' internalization to and identification with their university. We presented respondents the following statements on a Likert scale with anchor points 1 (strongly disagree) to 7 (strongly agree): "(1) I feel a sense of ownership for this university rather than being just an employee; (2) I talk up this university to my friends as a great organization to work for; (3) I would accept almost any type of job assignment in order to keep working for this university; (4) Since joining this university, my personal values and those of the university have become more similar; and (5) I find that my values and the university's values are very similar" (Cronbach's alpha 0.85).

### 5.2.4. Control variables

*Gender* (0 = male, 1 = female) was controlled for as men are usually more entrepreneurial than women (Crant, 1996; Zhao et al., 2005).

*Technical degree* (e.g., bio-science, physics, electronics, mechanics, and robotics) and *non-technical degree* (e.g., economics, law school, psychology, and MBA) assesses the degree researchers earned (0 = no, 1 = yes). Education is a key element of human capital, which is shown to affect the likelihood of becoming an entrepreneur (Mosey and Wright, 2007).

*Scientific experience* denotes the number of years respondents have spent in academia. Researchers' embeddedness in academia may lower the likelihood of producing commercial outputs (Ambos et al., 2008).

<sup>2</sup> However, as our conceptual framework is built upon identity theory, we included three additional items reflecting the importance of the inventor role in respondents' identity (i.e. items 6, 7 and 8; developed by Cardon et al. (2013) in the construction of their measurement instrument).

*Entrepreneurial experience* indicates whether or not researchers have ever started or attempted to start their own business, including any self-employment (0 = no, 1 = yes). Prior entrepreneurial exposure is positively related to entrepreneurial passion (Gielnik et al., 2015) and entrepreneurial intentions (Krueger, 1993; Zhao et al., 2005).

*Scientific discipline* was controlled for, as embeddedness in particular disciplines and their cultures is shown to influence individuals' propensity to shift toward entrepreneurship (Kenney and Goe, 2004). Specifically, four dummy variables represent (1) social and behavioral sciences (Social); (2) clinical medicine and pharmacy (Medicine); (3) engineering, technology and computer science (Engineering); and (4) life and agricultural sciences (Life) (reference category = natural sciences and mathematics).

Country dummies are included for Sweden, Germany, Slovenia, and Spain (reference category = Belgium).

### 5.2.5. Discriminant validity and common method variance

Before testing our hypotheses, we ran CFAs to check the distinctiveness of all measures under study. Concretely, discriminant validity is assessed for pairs of constructs by constraining the estimated correlation parameter between constructs to 1 and then performing a chi-square difference test on the values obtained from the constrained and unconstrained models (Anderson and Gerbing, 1988). For all 21 pairs of constructs, the chi-square values are significantly lower for the unconstrained models (i.e.  $\Delta \chi^2_{df} = 1 > 3.84$ ), which indicates discriminant validity. Furthermore, we tested if CMB was not unduly affecting our results. First, in line with the recommendations by Podsakoff et al. (2003), we applied Harman's one-factor test. CMB is assumed to exist if (1) a single factor emerges from unrotated factor solutions, or if (2) a single factor accounts for the majority of the variance (Podsakoff and Organ, 1986). Exploratory factor analysis on our data produced eight components, explaining 72% of the variance, with the first component explaining 18% (respectively 17% for start-up intentions) of the variance, thus providing initial evidence that CMB is unlikely to influence our findings. Second, we used CFAs to conduct the unmeasured latent method construct (ULMC) technique as outlined by Richardson et al. (2009) and Facticeau et al. (1995). Specifically, we analyzed four alternative measurement models, both for spin-off and start-up intentions, with the results presented in Table 2. Model 1 is a null measurement model (i.e. no factors underlie the data). Model 2 posits that a single method factor explained the data. Model 3 is the measurement model used in this study in which the constructs of interest ('traits') were positioned to underlie the data. Model 4 posits that the data could be accounted for by the traits in model 3 plus a single uncorrelated method factor.

The first important comparison for assessing CMB involves models 1 and 2. For both spin-off and start-up intentions, model 2 provides a significantly better fit for the data than model 1, but fits the data very poorly. The second comparison involves models 3 and 4. Model 3 in both cases provides a good fit for the data. Models 4, however, fit the data better than models 3. Yet, while statistically significant, the gain in fit achieved is relatively small. Subsequently, we partitioned the variation accounted for 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 the trait and the method factors, respectively. The amount of variance attributable to the method factor for spin-off intentions and start-up intentions was, respectively, 12% and 10%, which is generally considered to be low (Malhotra et al., 2006). Consequently, it is unlikely that CMB distorts our findings. Finally, our results are based upon complex estimations involving multiple independent variables and mediation terms, which are shown to be robust against CMB (Evans, 1985; Siemsen et al., 2010). Thus, these *ex post* considerations alleviate concerns related to the use of common respondents in our study.

## 6. Results

Table 3 presents descriptive statistics and the bivariate correlations among all variables, except for country and discipline dummies. Our sample researchers are 27.2% Swedish, 23.8% German, 5.2% Slovene, 15.6% Spanish and 28.2% Belgian. Half of our sample (49%) are women. As to their education, 1339 (58%) respondents have earned a technical degree (science, technology or engineering) and 1085 (47%) a non-technical degree (business, social sciences or humanities). On average, researchers indicated having 7.94 years of experience in academia (SD 6.11 years) and 17% of our sample has prior entrepreneurial experience. Our respondents carry out research activities in different scientific disciplines: 683 (29.6%) in social and behavioral sciences,

**Table 2**  
Results of ULMC procedure for spin-off intentions and start-up intentions.

Model	Chi-square	df	GFI	RMSEA	NFI
<i>Spin-off intentions</i>					
1	94,289***	325			
2	26,618***	324	0.43	0.23	0.74
3	6029***	314	0.79	0.10	0.94
4	2985***	287	0.90	0.07	0.97
<i>Start-up intentions</i>					
1	94,289***	325			
2	38,250***	299	0.44	0.24	0.74
3	7913***	289	0.79	0.11	0.94
4	3461***	263	0.90	0.07	0.97

GFI = goodness of fit index, RMSEA = root mean square error of approximation, NFI = normed-fit index.

\*\*\*  $p < 0.001$ .

**Table 3**

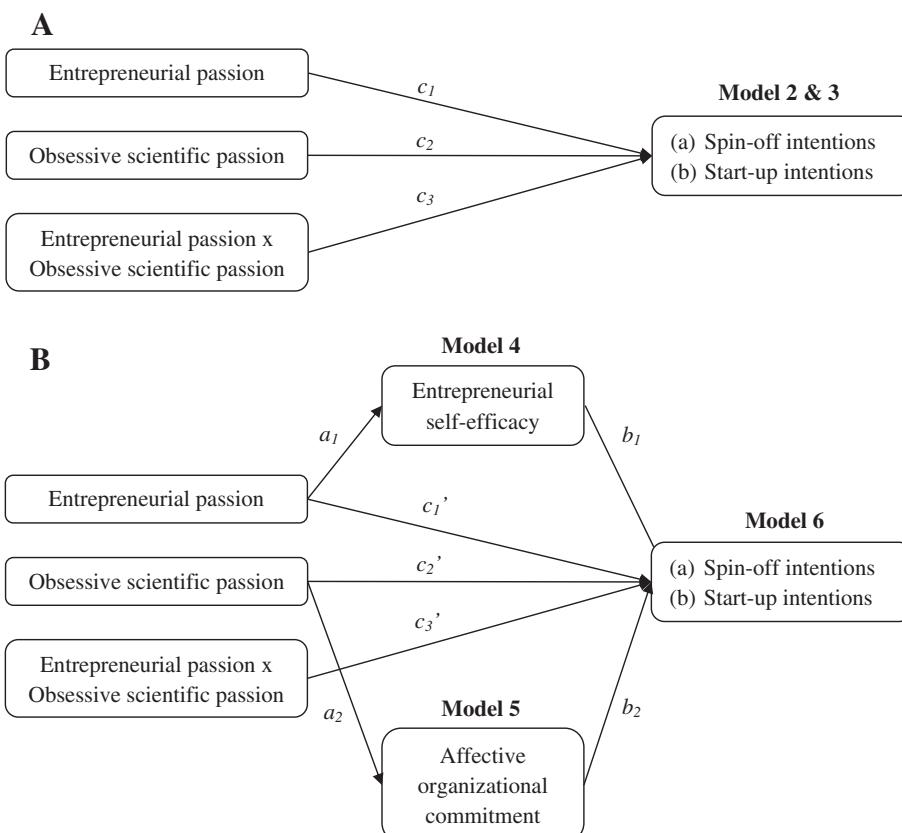
Descriptive statistics and correlations.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
(1) Gender <sup>a</sup>											
(2) Technical degree <sup>a</sup>		<b>-0.23</b>									
(3) Non-technical degree <sup>a</sup>		<b>0.20</b>	<b>-0.67</b>								
(4) Entrepreneurial experience <sup>a</sup>		<b>-0.12</b>	-0.03	<b>0.08</b>							
(5) Scientific experience		<b>-0.11</b>	-0.02	-0.01	<b>0.10</b>						
(6) Entrepreneurial passion		<b>-0.15</b>	<b>0.21</b>	<b>-0.14</b>	<b>0.19</b>	-0.01					
(7) Obsessive scientific passion		<b>-0.05</b>	0.03	-0.03	-0.01	0.03	<b>0.09</b>				
(8) Entrepreneurial self-efficacy		<b>-0.20</b>	<b>0.18</b>	<b>-0.11</b>	<b>0.24</b>	<b>0.04</b>	<b>0.67</b>	<b>0.16</b>			
(9) Affective organizational commitment		<b>-0.05</b>	0.02	0.02	0.00	0.03	<b>0.23</b>	<b>0.30</b>	<b>0.18</b>		
(10) Spin-off intentions		<b>-0.18</b>	<b>0.25</b>	<b>-0.19</b>	<b>0.17</b>	0.03	<b>0.54</b>	<b>0.10</b>	<b>0.50</b>	<b>0.18</b>	
(11) Start-up intentions		<b>-0.15</b>	<b>0.12</b>	<b>-0.05</b>	<b>0.36</b>	<b>-0.09</b>	<b>0.49</b>	<b>-0.05</b>	<b>0.48</b>	0.02	<b>0.44</b>
Mean	0.49	0.58	0.47	0.17	7.94	3.42	5.00	3.73	3.67	2.74	2.67
Standard deviation	0.50	0.49	0.50	0.37	6.11	1.47	1.28	1.24	1.27	1.54	1.57

Pearson correlation coefficients (1-tailed), indicating significant correlations ( $p < 0.05$ ) in bold;  $n = 2308$ .<sup>a</sup> Correlations of binary variables should be interpreted with care.

342 (14.8%) in clinical medicine or pharmaceutical research, 584 (25.3%) in engineering, technology or computer science, 331 (14.3%) in life or agricultural sciences, and 368 (16%) in natural sciences or mathematics.

Hierarchical OLS regression analyses test our hypotheses for both spin-off and start-up intentions. Variance inflation factors range between 1.04 and 2.87, indicating that multicollinearity is unlikely to be an issue in our study (Hair et al., 2006). We first add the control variables (baseline model or model 1), followed by the independent variables (main-effects-only model or model 2), and finally the interaction term (full model or model 3). The change in  $R^2$  between the baseline model (model 1) and the main-effects-only model (model 2) is significant for both outcome variables ( $p < 0.001$ ). In particular, for spin-off intentions (Table 4a), the addition of the two passion variables improves the explanatory power from 0.129 to 0.346, an increase of 21.7%. Similarly, for start-up intentions (Table 4b), our analyses reveal that adding entrepreneurial and scientific passion to the baseline model leads to a significant 16.1%  $R^2$  improvement from 0.185 to 0.346. Turning to the full model (model 3), including



**Fig. 2.** Conceptual model (Fig. 1) represented in the form of a path model, referring to OLS regression coefficients (Tables 4a and 4b).

**Table 4a**

OLS regression unstandardized coefficients (standard errors in parentheses) – spin-off intentions.

Outcome	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
	Spin-off intentions	Spin-off intentions	Spin-off intentions	Entrepreneurial self-efficacy	Affective organizational commitment	Spin-off intentions
Intercept	2.368*** (0.113)	0.125 (0.165)	1.098*** (0.275)	1.813*** (0.087)	1.966*** (0.149)	0.662* (0.277)
<i>Predictor</i>						
Entrepreneurial passion	$c_1 \rightarrow$ 0.495*** (0.019)	0.194** (0.071)	$a_1 \rightarrow$ 0.543*** (0.014)			$c_1' \rightarrow$ 0.026 (0.073)
Obsessive scientific passion	$c_2 \rightarrow$ 0.128*** (0.023)	-0.066 (0.049)		$a_2 \rightarrow$ 0.361*** (0.021)		$c_2' \rightarrow$ -0.126* (0.050)
Entrepreneurial self-efficacy						$b_1 \rightarrow$ 0.277*** (0.029)
Affective organizational commitment						$b_2 \rightarrow$ 0.069** (0.023)
Entrepreneurial x obsessive scientific passion		$c_3 \rightarrow$ 0.059*** (0.013)				$c_3' \rightarrow$ 0.060*** (0.013)
<i>Control</i>						
Gender	-0.315*** (0.059)	-0.176** (0.057)	-0.181*** (0.056)	-0.170*** (0.040)	-0.067 (0.053)	-0.126* (0.056)
Technical degree	0.345*** (0.079)	0.180* (0.076)	0.191* (0.075)	0.078 (0.054)	0.056 (0.071)	0.201** (0.075)
Non-technical degree	-0.060 (0.083)	-0.088 (0.079)	-0.089 (0.079)	-0.009 (0.056)	0.078 (0.074)	-0.077 (0.078)
Entrepreneurial experience	0.566*** (0.076)	0.244*** (0.074)	0.248*** (0.073)	0.350*** (0.052)	-0.001 (0.068)	0.168* (0.073)
Scientific experience	-0.007 (0.005)	-0.004 (0.004)	-0.004 (0.004)	0.005 (0.003)	0.001 (0.004)	-0.006 (0.004)
Social	-0.150 (0.102)	-0.114 (0.097)	-0.103 (0.097)	-0.015 (0.069)	0.154 (0.091)	-0.119 (0.096)
Medicine	0.349*** (0.106)	0.102 (0.101)	0.103 (0.101)	-0.161* (0.072)	0.025 (0.095)	0.153 (0.100)
Engineering	0.512*** (0.090)	0.219* (0.087)	0.201* (0.086)	-0.057 (0.061)	0.273*** (0.080)	0.195* (0.085)
Life	0.428*** (0.103)	0.219* (0.098)	0.224* (0.098)	-0.135† (0.070)	-0.077 (0.092)	0.259** (0.097)
Sweden	0.074 (0.076)	0.289*** (0.072)	0.292*** (0.071)	0.047 (0.051)	-0.425*** (0.067)	0.297*** (0.071)
Germany	0.093 (0.079)	0.158* (0.075)	0.171* (0.075)	0.199*** (0.053)	-0.587*** (0.070)	0.160* (0.075)
Slovenia	0.326* (0.133)	0.103 (0.127)	0.114 (0.126)	-0.054 (0.090)	-0.299** (0.118)	0.138 (0.125)
Spain	0.649*** (0.091)	0.792*** (0.094)	0.816*** (0.093)	0.063 (0.062)	0.195* (0.088)	0.756*** (0.093)
R <sup>2</sup>	0.129	0.346	0.352	0.487	0.149	0.377
F-statistic	31.486***	80.844***	77.615***	154.081***	28.364***	75.501***

n = 2308.

† p &lt; 0.10.

\* p &lt; 0.05.

\*\* p &lt; 0.01.

\*\*\* p &lt; 0.001.

the moderation effect causes a small increase in the amount of explained variance both for spin-off intentions ( $\Delta R^2 = 0.006$ ;  $p < 0.001$ ) and start-up intentions ( $\Delta R^2 = 0.001$ ;  $p < 0.10$ ). In order to test the proposed mediation effects we utilize a computational tool for path analysis-based conditional process modeling (Hayes, 2013). In particular, we used the PROCESS macro developed by Preacher and Hayes (2008), which relies on bootstrapping in order to disentangle the impact of direct and indirect effects (models 4 to 6). Fig. 2 translates our conceptual model (Fig. 1) into a path diagram, which consists of distinct submodels. Specifically, models 2 and 3 (in panel A of Fig. 2) represent the total effect models using OLS regression analysis, while models 4 to 6 (in panel B of Fig. 2) decompose these models and obtained effects, allowing for the estimation of bootstrap-indirect effects ( $a_1 * b_1$  and  $a_2 * b_2$ ). Models 4 and 5 predict the mediating variables, entrepreneurial self-efficacy and affective organizational commitment. Model 6 has spin-off or start-up intentions as outcome of interest, and also accounts for a moderation effect of obsessive scientific passion on the direct link between entrepreneurial passion and intentions ( $c_3'$ ). Tables 4a and 4b provide the results of the analyses for spin-off and start-up intentions respectively.

As for the control variables included in our regression analyses, in line with prior research and for both dependent variables, we find that men report greater entrepreneurial intentions than women and that there is a positive relationship between prior

**Table 4b**

OLS regression unstandardized coefficients (standard errors in parentheses) – start-up intentions.

Outcome	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
	Start-up intentions	Start-up intentions	Start-up intentions	Entrepreneurial self-efficacy	Affective organizational commitment	Start-up intentions
Intercept	2.387*** (0.108)	1.608*** (0.167)	1.175*** (0.279)	1.813*** (0.087)	1.966*** (0.149)	0.963*** (0.280)
Predictor						
Entrepreneurial passion		$c_1 \rightarrow$ 0.466*** (0.020)	0.600*** (0.072)	$a_1 \rightarrow$ 0.543*** (0.014)		$c_1' \rightarrow$ 0.435*** (0.073)
Obsessive scientific passion		$c_2 \rightarrow$ -0.118*** (0.023)	-0.032 (0.050)		$a_2 \rightarrow$ 0.361*** (0.021)	$c_2' \rightarrow$ -0.052 (0.050)
Entrepreneurial self-efficacy						$b_1 \rightarrow$ 0.317*** (0.030)
Affective organizational commitment						$b_2 \rightarrow$ -0.075*** (0.023)
Entrepreneurial $\times$ obsessive scientific passion			$c_3 \rightarrow$ -0.026† (0.013)			$c_3' \rightarrow$ -0.024† (0.013)
Control						
Gender	-0.323*** (0.056)	-0.205*** (0.057)	-0.203*** (0.057)	-0.170*** (0.040)	-0.067 (0.053)	-0.158** (0.057)
Technical degree	0.302*** (0.075)	0.094 (0.077)	0.089 (0.077)	0.078 (0.054)	0.056 (0.071)	0.049 (0.076)
Non-technical degree	0.101 (0.078)	0.051 (0.080)	0.051 (0.080)	-0.009 (0.056)	0.078 (0.074)	0.052 (0.079)
Entrepreneurial experience	1.468*** (0.072)	1.127*** (0.075)	1.125** (0.075)	0.350*** (0.052)	-0.001 (0.068)	1.005*** (0.075)
Scientific experience	-0.035*** (0.004)	-0.029*** (0.005)	-0.029*** (0.005)	0.005 (0.003)	0.001 (0.004)	-0.030*** (0.004)
Social	0.139 (0.097)	0.103 (0.098)	0.098 (0.098)	-0.015 (0.069)	0.154 (0.091)	0.101 (0.097)
Medicine	0.272** (0.101)	0.031 (0.102)	0.030 (0.102)	-0.161* (0.072)	0.025 (0.095)	0.079 (0.101)
Engineering	0.520*** (0.085)	0.145† (0.088)	0.152† (0.088)	-0.057 (0.061)	0.273*** (0.080)	0.176* (0.086)
Life	0.211* (0.098)	-0.008 (0.099)	-0.010 (0.099)	-0.135† (0.070)	-0.077 (0.092)	0.035 (0.098)
Sweden	-0.001 (0.072)	0.172* (0.073)	0.171* (0.073)	0.047 (0.051)	-0.425*** (0.067)	0.146* (0.072)
Germany	-0.011 (0.075)	0.082 (0.076)	0.077 (0.076)	0.199*** (0.053)	-0.587*** (0.070)	-0.031 (0.076)
Slovenia	0.211† (0.127)	-0.071 (0.128)	-0.075 (0.128)	-0.054 (0.090)	-0.299** (0.118)	-0.113 (0.127)
Spain	0.179* (0.086)	-0.030 (0.095)	-0.040 (0.095)	0.063 (0.062)	0.195* (0.088)	-0.101 (0.094)
R <sup>2</sup>	0.185	0.346	0.347	0.487	0.149	0.379
F-statistic	51.511***	80.760***	76.039***	154.081***	28.364***	76.051***

n = 2308.

† p &lt; 0.10.

\* p &lt; 0.05.

\*\* p &lt; 0.01.

\*\*\* p &lt; 0.001.

entrepreneurial experience and entrepreneurial intentions. In addition, researchers holding a technical degree (in science, technology, or engineering) have stronger intentions to engage in spin-off and start-up creation. Furthermore, the more experience they have in academia, the lower is the researchers' propensity to set up a start-up company. However, we do not detect a similar link with spin-off intentions. Finally, we also observe some country and discipline effects. For instance, Swedish and Spanish researchers consistently show greater spin-off intentions compared to their counterparts in Eastern and Germanic Europe. Likewise, our analyses reveal that researchers in medicine, engineering or life sciences have higher levels of both types of entrepreneurial intentions.

Model 2 reveals a significantly positive coefficient for entrepreneurial passion both for spin-off intentions ( $c_1 = 0.495$ ;  $p < 0.001$ ), reported in Table 4a, and start-up intentions ( $c_1 = 0.466$ ;  $p < 0.001$ ), shown in Table 4b. Thus, we find support for Hypothesis 1a and 1b. Models 4 and 6 disentangle model 2 in order to evaluate whether indirect effects of entrepreneurial passion through entrepreneurial self-efficacy exist. Focal coefficients in these models are  $c_1'$ , referring to the direct path from entrepreneurial passion to entrepreneurial intentions, just as  $a_1$  and  $b_1$ , which jointly allow to assess the indirect path through entrepreneurial self-efficacy. The difference between the total effect ( $c_1$ ) and the direct effect after controlling for a proposed mediator

( $c_1'$ ) is the indirect effect of entrepreneurial passion on entrepreneurial intentions through entrepreneurial self-efficacy ( $a_1 * b_1$ ). A formal test of this difference indicates whether entrepreneurial self-efficacy acts as a mediator, as predicted by **Hypotheses 2a and 2b**. A 95% confidence interval for this indirect effect, based on 10,000 bootstrap samples, was found to be between 0.115 and 0.184 for spin-off intentions ( $a_1 * b_1 = 0.150$ ) and between 0.136 and 0.203 for start-up intentions ( $a_1 * b_1 = 0.172$ ). As zero is not included in the interval for both dependent variables, entrepreneurial self-efficacy can be construed as a mediator between entrepreneurial passion and the two types of entrepreneurial intentions, so we accept **Hypothesis 2a** and **Hypothesis 2b**.

Turning to the link between obsessive scientific passion and entrepreneurial intentions, model 2 demonstrates a significantly positive coefficient for spin-off intentions ( $c_2 = 0.128$ ;  $p < 0.001$ ; **Table 4a**), and a significantly negative effect on start-up intentions ( $c_2 = -0.118$ ;  $p < 0.001$ ; **Table 4b**). This provides support for **Hypotheses 3a and 3b**. Following the same logic as above for the mediation effect, models 5 and 6 decompose model 2 such that the indirect effect of obsessive scientific passion through affective organizational commitment can be assessed for both types of entrepreneurial intentions (**Hypotheses 4a and 4b**; coefficients  $a_2$  and  $b_2$ ). Our analyses indicate that 95% of the bootstrap estimates of the indirect effect are between 0.007 and 0.040 for spin-off intentions ( $a_2 * b_2 = 0.025$ ), and between  $-0.043$  and  $-0.010$  for start-up intentions ( $a_2 * b_2 = -0.027$ ). Since zero is not included in these confidence intervals, we accept **Hypotheses 4a and 4b**.

Finally, an estimate and test of the significance of path  $c_3$  in model 3 is used to determine whether and how obsessive scientific passion moderates the relationship between entrepreneurial passion and entrepreneurial intentions (**Hypotheses 5a and 5b**). As shown in **Table 4a**, our analyses confirm a significantly positive moderation effect for spin-off intentions ( $c_3 = 0.060$ ,  $p < 0.001$ ), thus supporting **Hypothesis 5a**. The size of the effect is such that researchers exhibiting high levels of entrepreneurial passion show a 18% increase in spin-off intentions from minus 1 to plus 1 standard deviation in obsessive scientific passion. We further plotted the interaction to determine the nature of the relationship. **Fig. 3** indicates that researchers with high levels of entrepreneurial passion have greater intentions to found a spin-off, especially if they are also highly obsessively passionate about their scientific role. In other words, obsessive scientific passion reinforces the positive impact of entrepreneurial passion on spin-off intentions. In the case of start-up intentions, presented in **Table 4b**, the coefficient  $c_3$  is negative but not statistically significant ( $c_3 = -0.024$ ,  $p < 0.10$ ). Hence, we do not find support for **Hypothesis 5b**. The size of the coefficient indicates that individuals with high entrepreneurial passion show a decrease in start-up intentions by 11% from minus 1 to plus 1 standard deviation in obsessive scientific passion.

### 6.1. Post hoc analyses and robustness checks

We conducted a number of post hoc analyses to provide more fine-grained insights and to assess the robustness of our results.

First, in order to examine and correct for potential endogeneity problems in our study, we carried out instrumental variable analyses complemented with Sargan and Durbin-Wu-Hausman tests, as recommended by [Baum \(2006\)](#) and [Bascle \(2008\)](#). We specifically used this approach for the obsessive scientific passion-affective organizational commitment relationship, where simultaneous causality may affect our results.<sup>3</sup> We found respondents' scientific productivity – measured as the number of peer-reviewed publications – and scientific experience – measured as the time spent in academia – to be two reliable instrumental variables. The results of the two-stage least squares (2SLS) regression analyses and related Sargan (Sargan chi-squared test: 0.050, p-value = 0.823) and Durbin-Wu-Hausman (Durbin-Wu-Hausman chi-squared test: 2.130, p-value = 0.144) tests indicate that simultaneous causality or potential endogeneity issues are not unduly biasing our findings.

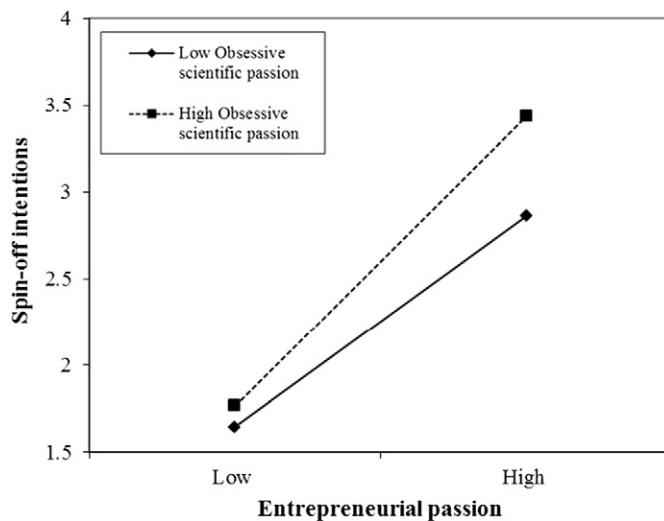
Second, while we controlled for a number of elements, such as discipline and country, our data is hierarchical, in such way that respondents are nested in universities, which are in turn nested in countries. In order to verify whether this clustering of the data affects our results, we reran our analyses using the CLUSTER option in the PROCESS macro as a robustness check. Specifically, PROCESS then produces  $k-1$  dummy variables coding which of the  $k$  clusters a case is nested in. As the macro limits the number of clusters to be considered to 20, we eliminated observations from the four universities with the fewest responses, as such reducing our sample to 2202 observations, while also removing the country dummies. This statistical procedure echoed our initial findings, indicating that such clustering is not biasing our results.

Third, we conducted Structural Equation Modeling (SEM) to ensure the robustness of our findings. We take advantage of SEM by including both dependent variables in the same model and by allowing their residuals to correlate (due to potential shared method variance for spin-off and start-up intentions). The empirical results using SEM mirrored our initial results using PROCESS, and model fit was within acceptable thresholds (comparative fit index [CFI] = 0.97; root mean square of approximation [RMSEA] = 0.09 (90% confidence interval [CI]: 0.08–0.11); standardized root mean square residual [SRMR] = 0.05).

Fourth, since [Stock and Watson \(2007\)](#) indicate that one should always assume that heteroscedasticity is present, we took measures to ensure it is not causing spurious findings. Therefore, we reran our analyses using the HC3 estimator for robust standard errors, described in [Long and Ervin \(2000\)](#) and [Hayes and Cai \(2007\)](#). The results of this procedure point to similar results and evaluation of our hypotheses.

Finally, we carried out additional analyses for one of the core elements of our paper, namely the interaction between entrepreneurial and obsessive scientific passion (model 2 in **Tables 4a and 4b**). Specifically, we used the Johnson-Neyman technique to evaluate whether the interaction effect was statistically significant at all levels of the moderator variable. As there are no statistically significant transition points within the observed range of the moderator variable, we find confirmation for the existence

<sup>3</sup> We thank one of the reviewers for pointing to the potential simultaneous causality in this relationship.



**Fig. 3.** Moderation effect of obsessive scientific passion on the relationship between entrepreneurial passion and spin-off intentions (Hypothesis 5a).

of the moderation effect at all levels of the moderator variable. In addition, Edwards (2009) specifies that the risk of Type I error for testing a moderation  $X \times Z$  may increase as the moderation can be inferred when curvilinearity is responsible for the variance explained by the moderation term. Therefore, we reran model 3, also including the squared terms for scientific and entrepreneurial passion, finding similar results both in terms of direction and significance of the moderator term. Furthermore, in our main analyses, we hypothesized and tested the existence of an overall interaction effect between entrepreneurial passion and obsessive scientific passion. Disentangling this effect revealed that the interaction takes place on the direct path for spin-off intentions (0.076,  $p < 0.001$ ), and on the entrepreneurial self-efficacy-intentions relation in the indirect path for start-up intentions ( $-0.034$ ,  $p < 0.10$ ).

## 7. Discussion and conclusion

The aim of this paper is to disentangle organization members' "passion orchestra," i.e. the simultaneous occurrence of different passion types within the organization-embedded individual that could work in concert or hinder each other. We study our research question in a particularly relevant setting, namely academia, where individuals are expected to execute a variety of activities and to take on multiple role identities. We use survey data from 2308 researchers working at 24 universities in five European countries to assess the relation between the "passion orchestra" and entrepreneurial intentions. Our findings confirm that spin-off and start-up intentions are distinct constructs. Further, variations among university researchers in their "passion orchestra" lead them to have different types of entrepreneurial intentions. In particular, we offer empirical evidence that researchers' entrepreneurial passion and obsessive scientific passion are associated differently with spin-off and start-up intentions. Concretely, while our analyses show that entrepreneurial passion is positively related to both spin-off and start-up intentions, researchers with high levels of obsessive scientific passion show greater intentions to engage in the founding of a spin-off company, and lower start-up intentions. Furthermore, we identify entrepreneurial self-efficacy and affective organizational commitment as important mediators in these relations. Finally, central to our exploration of the "passion orchestra," we find that obsessive scientific passion acts as a moderator in the entrepreneurial passion–intentions relationship. In particular, the two passions reinforce each other in the case of spin-off intentions. This illustrates the importance of considering different types of passion and their interplay instead of studying entrepreneurial passion in isolation.

### 7.1. Implications for research and practice

Our findings contribute in several ways. For academia, first, it contributes to the literature on (entrepreneurial) passion, which has so far exclusively focused on one type of passion (e.g., entrepreneurial passion, work passion). As identity theorists have long recognized that a person's self-concept is comprised of a myriad of identities, our work posits that individuals can simultaneously hold a variety of passions, and that their interplay, or the "passion orchestra," rather than entrepreneurial passion as a sole element, affects the new venture creation process. In particular, our study is unique in examining how passion related to one's (actual) work role identity and passion related to one's (possible) entrepreneurial identity jointly influence the nascent stages of the entrepreneurial process, i.e. the origin of entrepreneurial intent while the individual is still employed by an established organization. Furthermore, drawing on the nature of their underlying identities, we demonstrate that multiple passions coming together in an individual's "passion orchestra" can enhance each other. In addition to these direct and interaction effects, we elucidate the two underlying mechanisms through which passion types exert an influence. Our study also constitutes a theoretical

and empirical extension of the entrepreneurial passion literature that, so far, only studies the phenomenon of entrepreneurial passion using samples of entrepreneurs. Building upon the tenets of identity theory, we indicate that entrepreneurial passion can also reside within individuals who are not yet engaging in entrepreneurship, but who adopt an entrepreneurial identity in their future-oriented self-concept. Subsequently, the theoretically driven conceptualization of the “passion orchestra” provides a starting point for a broad range of fascinating research questions in other contexts presuming multiple congruent or competing role identities. One example of such a context are social enterprises where individuals face the challenge of pursuing financial goals and social impact simultaneously (Mair et al., 2006; Peredo and McLean, 2006), and thus their passion for economic gain and passion for social cause could work in concert.

Second, our paper enriches the (*academic*) *entrepreneurship literature* by studying the “passion orchestra” underlying the formation of entrepreneurial intentions in academia. In that way, we also respond to calls for a more profound understanding of the antecedents of entrepreneurial intentions rising out of existing work organizations (e.g., Nanda and Sørensen, 2010; Sørensen and Fassiotto, 2011). At the same time, the identification of the joint influence of entrepreneurial and scientific passion sheds new light on ambidexterity issues at the individual level in a university context (Ambos et al., 2008), where researchers are pressured to combine scientific and commercialization activities.

For practitioners, including *government agencies and TTOs*, our study draws attention to the importance of researchers' affectionate displays for academic entrepreneurship. Our results indicate that entrepreneurial and scientific passion can reinforce each other when related to spin-off intentions. Given the time and budgetary constraints of actors such as TTOs (Jones-Evans and Klofsten, 1999; Siegel et al., 2003), it may be desirable to focus specifically on researchers with high levels of both passion types, i.e. those individuals exhibiting a strong dedication for scientific research and desire to search for new solutions to business problems. From the viewpoint of *university managers*, this research also informs the question whether they should create an environment where researchers are expected to wear ‘two hats’ or to focus on one or the other role (i.e. exploration or scientific activities versus exploitation or entrepreneurial activities). The detection of the combined positive effect of scientific and entrepreneurial passion on spin-off intentions suggests the former option, as the two roles may complement and even reinforce each other. By extension, by revealing how (obsessive) work passion and entrepreneurial passion work come together within a person, our study also has implications for *knowledge-intensive organizations*; particularly those considering corporate entrepreneurship as part of their members' career trajectory.

## 7.2. Limitations and directions for future research

This study has a number of limitations that may lead to future research avenues. First, the cross-sectional nature of our data calls for prudence in the interpretation of the findings as causality cannot be evaluated even though our theory supports it. For instance, since affect and cognition are closely intertwined and cooperating systems (Zajonc, 1980), the relationship between passion and self-efficacy might be bidirectional. In fact, while Cardon and Kirk (2015) argue for entrepreneurial self-efficacy to affect entrepreneurial passion, Murnieks et al. (2014) suggest, in line with our study, the reverse relationship, indicating the possibility of a circular loop. As a result of the cross-sectional nature, we are also unable to investigate the impact of configurational changes in the “passion orchestra” on entrepreneurial intentions, nor to observe whether and when intentions translate into the creation of spin-offs and/or start-ups. Along the same lines, it would be interesting to test whether and how an individual's entrepreneurial efforts, through their reciprocal influence on entrepreneurial passion (Gielnik et al., 2015), modify the “passion orchestra” and its effects. Consequently, future studies using a longitudinal research lens could test a more dynamic model and scrutinize these questions.

A second limitation is that institutional forces and organizational practices, which are beyond the scope of this study, may trigger or restrain researchers from having high levels of scientific and/or entrepreneurial passion. Therefore, future work using multilevel research designs could purposefully assess how institutional differences cause divergence in individuals’ “passion orchestra” or how organizational factors play a moderating role in the passion-intentions relationship. Addressing these issues would not only provide insights into antecedents or boundary conditions of the “passion orchestra,” but also serve to inform universities as to how they can design jobs or develop organizational policies that help nurture researchers' scientific and entrepreneurial passions.

Third, this paper deliberately focuses on spin-off and start-up intentions, without specifying a time frame for such intentions to mature (which is in line with extant literature). However, as research commercialization includes a broad spectrum of mechanisms (e.g., university spin-offs, patents, licensing, contract research and consulting) (Wright et al., 2008), future studies could assess the impact of researchers' “passion orchestra” on their intentions to engage in these different commercialization activities. Furthermore, future research could incorporate the individual's time horizon in measuring entrepreneurial intentions, identifying how much time an individual expects to elapse before intentions become actions.

Fourth, even though a number of tests and model specifications make it unlikely that CMB affects our results, we suggest that future studies using self-report data could apply design and measurement strategies that are helpful in ruling out such bias. For instance, as Spector (2006) points out, it may be relevant to conduct a series of studies in order to test for biases that may distort the previously observed relationships, as such using time variation as an effective means to control for factors influencing measurement at a given point in time.

Fifth, we only postulate two mediators in the “passion orchestra”–entrepreneurial intentions relationship. Nevertheless, alternative or complementary theoretical frameworks may inform the existence of additional mediational paths, for instance through job satisfaction or role stress.

Finally, the extent to which our findings hold outside academia warrants further research. The generalizability of our conceptual model could be tested in other organizations in which employees may simultaneously experience different types of passion, in so doing providing insights into the microfoundations of knowledge workers' mobility (Campbell et al., 2012). Differences in the "passion orchestra" could also explain individuals' intentions to become an entrepreneur or an intrapreneur, as such extending the work by Douglas and Fitzsimmons (2013), and clarify why some organization members enter hybrid entrepreneurship relative to full-time self-employment (Folta et al., 2010; Raffiee and Feng, 2014). Further, future research that explores how prospective entrepreneurs may be driven by the convergence of entrepreneurial passion and passion for non-entrepreneurial roles related to their (future) core business activity or craft (e.g., passion for music, fashion, design, IT) is likely to make an important contribution to the literature. Future research could also investigate how an entrepreneur's "passion orchestra" leads to a preferred mode of exploitation or differences in growth ambition levels, thereby considering passion for founding and passion for developing as respective parts of the "passion orchestra." Scholars could further study the implications of different combinations of harmonious and/or obsessive and entrepreneurial and/or work passions for a broad range of individual, work-related and new venture-related outcomes.

In conclusion, our study finds that researchers' "passion orchestra" impacts their entrepreneurial intentions, both directly and indirectly through entrepreneurial self-efficacy and affective organizational commitment, and that these results vary for spin-off versus start-up intentions. We hope that our findings inspire further research on the impact of individuals' "passion orchestra" in diverse (organizational) contexts and throughout different stages of the entrepreneurial process.

## Acknowledgments

The authors gratefully acknowledge the guidance and feedback we received from editor Phillip Phan and three anonymous reviewers. We would further like to express our appreciation for the valuable comments on earlier drafts provided by Maw Der Foo, participants from the 2014 Babson College Entrepreneurship Research Conference and the 2014 Academy of Management Annual Meeting. The first author gratefully acknowledges the financial support provided by Research Foundation Flanders (FWO12/ASP\_H/145) in undertaking this research.

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