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Integrating psychological approaches to entrepreneurship: the Entrepreneurial Personality System (EPS)

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Abstract Understanding the psychological nature and development of the individual entrepreneur is at the core of contemporary entrepreneurship research. Since the individual functions as a totality of his or her single characteristics (involving the interplay of biological, psychosocial, and context-related levels), a person-oriented approach focusing on intraindividual dynamics seems to be particularly fruitful to infer realistic implications for practice such as entrepreneurship education and promotion. Applying a person-oriented perspective, this paper integrates existing psychological approaches to entrepreneurship and presents a new, person-oriented model of entrepreneurship, the *Entrepreneurial Personality System (EPS)*. In the empirical part, this model guided us to bridge two separate research streams dealing with entrepreneurial personality: research on broad traits like the Big Five and research on specific traits like risk-taking, self-efficacy, and internal locus of control. We examine a gravity effect of broad traits, as assumed in the *EPS* framework, by analyzing large personality data sets from three countries. The results reveal a consistent gravity effect of an intraindividual entrepreneurial Big Five profile on the more malleable psychological factors. Implications for entrepreneurship research and practice are discussed.

Keywords Personality · Traits · Big Five · Identity · Entrepreneurship · Self-employment · Biology · Context · Development · Psychology

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1 Introduction

It is generally acknowledged that at the center of the entrepreneurial process stands the individual entrepreneur as key agent. It is therefore important to understand this individual if one wants to have a better understanding of the entrepreneurial process and related topics such as entrepreneurial success and failure, entrepreneurship education, entrepreneurial culture, and the like. Indeed, one of the traditional research questions in the scholarly investigation of entrepreneurship is to better define and understand the entrepreneurial personality, for example those personality components and their interplay that make entrepreneurial behavior more likely in the general population (Hisrich et al. 2007). Already, the seminal theorizing by Knight (1921), McClelland (1961), and Schumpeter (1934) predicted that one key perspective towards a scientific understanding of entrepreneurship is the identification and in-depth examination of

personality characteristics. The topic has been receiving considerable attention in recent years, and there is even a "meta-analysis" on existing meta-analytic findings in this field (Brandstätter 2011). However, despite these intensified research efforts, the existing entrepreneurship literature is still surprisingly underdeveloped when it comes to an integrative definition of the entrepreneurial personality as a coherent whole. Such a focus on the individual as a dynamic system characterized by both stability and plasticity and intraindividual dynamics between the more stable and the more malleable components, which has become a leading perspective in modern psychological science, is indeed largely missing in contemporary entrepreneurship research. This paper seeks to make a new contribution in this field.

Why is this necessary and important? To illustrate, let us assume that the entrepreneurial mindset is comparable to a sheet of music for a complex piano sonata. Understandably, focusing on single components and notes of the sheet of music will not make it possible to understand the melody and structure of the sonata as a whole. Only if we look at the specific structure of all notes and their dynamics (e.g., how they relate to each other), we can understand the gestalt of the sonata, because the whole is clearly more than just the simple sum of its parts here. We believe that this gestalt perspective is indeed useful to understand the entrepreneurial mindset, which has important implications for research and practice. For example, to stick with this sonata example, one could compare entrepreneurship education with the effort of transforming this piano sonata into a successful pop song. This might require both understanding and keeping the unique "identity" and central melody of the sonata but also adding some bits and pieces that integrate into, and harmonize with, this central identity of the sonata to turn this into a pop song. The same might be true for realistic entrepreneurship education efforts, which should consider the gestalt of the individual's personality and its individual history, and thus the structure and dynamics of all personality components.

Such a focus on the gestalt of an individual's personality has a long tradition in psychological science. Many personality psychologists agree that a person's personality is best defined as the totality of his or her personality components, stretching from biologically related characteristics to more malleable characteristics, because the individual functions as a coherent whole. This holistic person-oriented perspective stretches back to Gordon Allport (1923), one of the fathers of personality psychology, who stressed: "More fundamental than differential psychology [i.e., the psychometric focus on dimensions of difference among people], by far, is the problem of the nature, the activity, and the unity of the *total personality*" (p. 614; emphasis in the original). Hence, modern personality models in contemporary personality research seek to combine the different personality components within a person's personality structure to get a holistic picture of the individual (Gottlieb 2003; Magnusson and Törestad 1993; McAdams and Pals 2006). The main argument here is that one can only understand the behavioral and psychosocial outcomes of a person's personality (e.g., work-related outcomes such as entrepreneurship) if one is able to understand the personality of a person as a coherent whole, as a system with specific dynamics between the single components of the personality system (e.g., coherence tendencies, Cervone and Shoda 1999; Sheldon and Kasser 1995). One prominent example is the elaboration of the Big Five traits approach (McCrae and Costa 2008)—the dominating biologically based trait taxonomy in contemporary personality science (Benet-Martínez and John 1998; Digman 1990)—by considering a system perspective that connects the Big Five traits level with the other, more changeable components of an individual's personality (e.g., characteristic adaptations and self-concept). This resulted in the *Five-Factor Theory (FFT) Personality System* model (McCrae and Costa 2008).

In extending previous efforts to structure the entrepreneurial personality (e.g., Baum and Locke 2004; Brandstätter 2011; Leutner et al. 2014; Rauch and Frese 2007a) and to capture intraindividual dynamics that are crucial for entrepreneurial outcomes and related fields, in this paper, we introduce this *FFT Personality System* model (McCrae and Costa 2008) into entrepreneurship research. We apply this general personality system model and term it *Entrepreneurial Personality System (EPS)*. In the following, we first briefly discuss existing entrepreneurship research on the role of personality differences, and then proceed with a description of the *FFT Personality System* model. We will then infer a system model of the entrepreneurial personality and put an important part of that model—the gravity effect of

Big Five traits on specific traits within the entrepreneurial personality—to an empirical test by examining mediation models with broad traits, specific traits, and self-employment outcomes.

2 Existing entrepreneurship research on personality

Existing entrepreneurship research showed biologically based personality traits such as the Big Five traits (extraversion, conscientiousness, openness, agreeableness, and neuroticism, Digman 1990; McCrae and Costa 2008) to relate to entrepreneurship (e.g., Brandstätter 2011; Zhao et al. 2010; Obschonka et al. 2013). Such broad traits have a substantial genetic basis and are relatively (but not perfectly) stable over the life span, which suggests that biological factors matter for entrepreneurship. This notion is underscored by genetic studies demonstrating a substantial biological underpinning of entrepreneurship (Nicolaou et al. 2008), which can be, at least in part, explained by the mediating mechanisms of Big Five traits (Shane et al. 2010).

Hence, in order to understand the entrepreneurial personality, it is necessary to consider the biologically based fundament of a person's personality—for example broad traits such as the Big Five. Prior studies on the role of Big Five traits often either studied the single Big Five traits and their effects on entrepreneurship in isolation of each other (variable-oriented approach) or an entrepreneurial constellation of the Big Five traits within the individual (person-oriented approach). As stressed by Magnusson and Törestad (1993), both approaches—the variable-oriented and the person-oriented approach—can help to come to a better understanding of personality and its effects on behavior, but if one really wants to understand the single individual as a coherent whole, it is particularly fruitful to consider trait patterns within the individual, given the logic of a holistic approach on personality (Allport 1923).

Research indicates that higher values in extraversion, conscientiousness, and openness and lower values in agreeableness and neuroticism relate to entrepreneurship (Costa et al. 1984; De Fruyt and Mervielde 1997, 1999; Zhao and Seibert 2006; Zhao et al. 2010). Applying a person-oriented perspective (Block 1971; Magnusson and Törestad 1993), and consistent with seminal theorizing on the entrepreneurial personality (Schumpeter 1934), one can define an intraindividual entrepreneurial constellation of the Big Five traits as high values in extraversion, conscientiousness, and openness and low values in agreeableness and neuroticism (Obschonka et al. 2013; Schmitt-Rodermund 2004). Not surprisingly, from a holistic person-oriented perspective (Magnusson and Törestad 1993), this intraindividual entrepreneurial Big Five profile shows more consistent and robust effects than the single Big Five traits (Obschonka et al. 2013, 2014). At the individual level, this entrepreneurial Big Five profile predicts entrepreneurial behavior and underlying intentions, attitudes, control beliefs, entrepreneurial alertness, self-identity, skills, and social capital (Arnaud 2011; Obschonka et al. 2016a, b; Schmitt-Rodermund 2004, 2007; Stuetzer et al. 2013; for an overview of studies see also Obschonka et al. 2013). Evaluation research suggests that the effectiveness of public business advice for nascent entrepreneurs depends as a function of this entrepreneurial Big Five profile (Kösters and Obschonka 2011). This profile, which mirrors the logic of a balanced skill set in entrepreneurs (see Stuetzer et al. 2013), also helps explain the pervasive gender gap in entrepreneurial activity around the globe (Obschonka et al. 2014). At the regional level, this profile predicts entrepreneurial activity across regions in various countries such as the USA, Germany, and the UK (Audretsch et al. 2016; Obschonka et al. 2013) and interacts with regional knowledge resources (Obschonka et al. 2015) and might therefore help in solving the knowledge paradox in economics (Audretsch and Keilbach 2008). The regional prevalence of this profile also predicts regional economic growth (Stuetzer et al. 2016b) and regional economic resilience (a robust entrepreneurial vitality in the region during a major economic crisis, Obschonka et al. 2016c). Research on the economic history of regions using an instrumental variable design indicates that both entrepreneurial behavior and the entrepreneurial Big Five profile share a similar historical root—the region's dominating industry structure during the Industrial Revolution era and subsequent path dependencies (Stuetzer et al. 2016a).

Beside the research on the link between broad traits and entrepreneurship, other entrepreneurship studies showed that more narrowly defined and changeable personality characteristics like self-efficacy, risk-taking, need-for-achievement, and control beliefs (e.g., self-efficacy) also relate to entrepreneurship (e.g., Brandstätter 2011; Rauch and Frese

2007b; Stewart and Roth 2001). The existing entrepreneurship literature sometimes uses the term "specific traits" for these characteristics (e.g., Rauch and Frese 2007a, b). Such specific traits, in contrast to the more stable Big Five traits, have received more attention in entrepreneurship research and practice so far because they are, from a conceptual perspective, more proximal to the entrepreneurial activity than the relatively abstract and broad Big Five traits (Rauch and Frese 2007b), and they are of course, in principle, much easier to change. This raises two important questions. First, one could argue that research focusing on specific traits behind entrepreneurial behavior may provide a window on how to intervene when aiming to promote entrepreneurial mindsets. Indeed, many entrepreneurship education programs target such specific traits like self-efficacy or risk-taking in order to promote entrepreneurial mindsets and thus entrepreneurial behavior (Wilson et al. 2007). However, evaluation research showed that entrepreneurship education programs often show small or no effects, particularly in the long run (Oosterbeek et al. 2010), and the question is still on the table whether it is really possible to change specific entrepreneurial traits in an enduring way (e.g., to stimulate long-term effects that translate into actual entrepreneurial behavior). As explained in more detail in the following, the *FFT Personality System* model (McCrae and Costa 2008) assumes a certain gravity of (the relatively stable) broad traits behind specific traits (the question we empirically test in this paper). Thereby, gravity means that specific traits are an expression of the enduring core of a person's personality. Gravity signals a characteristic adaptation of the person across time and situations (e.g., developing a certain self-efficacy).

Second, there is also the question of whether one should define these "softer" and more narrowly defined entrepreneurial personality characteristics as traits at all (e.g., specific traits), because in personality psychology, traits are usually defined as relatively stable personality characteristics of a person like the Big Five (Digman 1990; McCrae and Costa 2008). It might also be correct to call these specific trait attitudes and belief patterns (Bandura 1997). As explained in the following, the *FFT Personality System* model (McCrae and Costa 2008) uses the term traits exclusively for the Big Five level.

3 The Entrepreneurial Personality System

We apply the *FFT Personality System* model (McCrae and Costa 2008) to achieve a system perspective on the entrepreneurial personality—*the Entrepreneurial Personality System (EPS)* (see Fig. 1). Although such a system perspective does not only figure prominently in personality research but also in vocational psychology (Rottinghaus and Miller 2013), it has not been applied to entrepreneurship yet. As noted above, one fundamental assumption in personality psychology is that one cannot understand how traits operate (e.g., how they affect behavior) if one does not understand personality as a system. McCrae and Costa (2008) therefore stress that "it is necessary to describe personality itself, the dynamic psychological organization that coordinates experience and action" (p. 162). The *FFT Personality System* model (McCrae and Costa 2008) thus combines the Big Five traits level with a characteristic adaptation level and a self-concept level, thereby taking a leading system perspective of personality according to which personality is mainly composed of a dynamic system of biologically based traits, evolving patterns of thoughts, attitudes, beliefs, and feelings, and a developing self-concept (McAdams and Pals 2006).

Basic tendencies such as the Big Five personality traits are relatively stable, "broad individual differences in behavior, thought, and feeling that account for general consistencies across situations and over time" (McAdams and Pals 2006, p. 212). They have a strong genetic basis and stand for the person's "abstract psychological potentials" (McCrae and Costa 2008, p. 163). The *FFT Personality System* model assigns the term "traits" exclusively to this basic tendency category (McCrae and Costa 2008). In the context of entrepreneurship, the basic tendency level connects the biological basis (e.g., biologically based traits) with the more adaptive part of the *EPS* (characteristic adaptations and self-concept) and thus with entrepreneurial thinking and acting (Shane et al. 2010). It is an important mediator through which biological factors affect entrepreneurial outcomes. Following earlier research on Big Five traits and entrepreneurship as described above, one can either define the single, separate Big Five traits or an intraindividual entrepreneurial constellation of Big Five traits within the individual as entrepreneurial basic tendencies of a person (Obschonka et al. 2013). In the empirical part of this study, we thus examine both approaches.

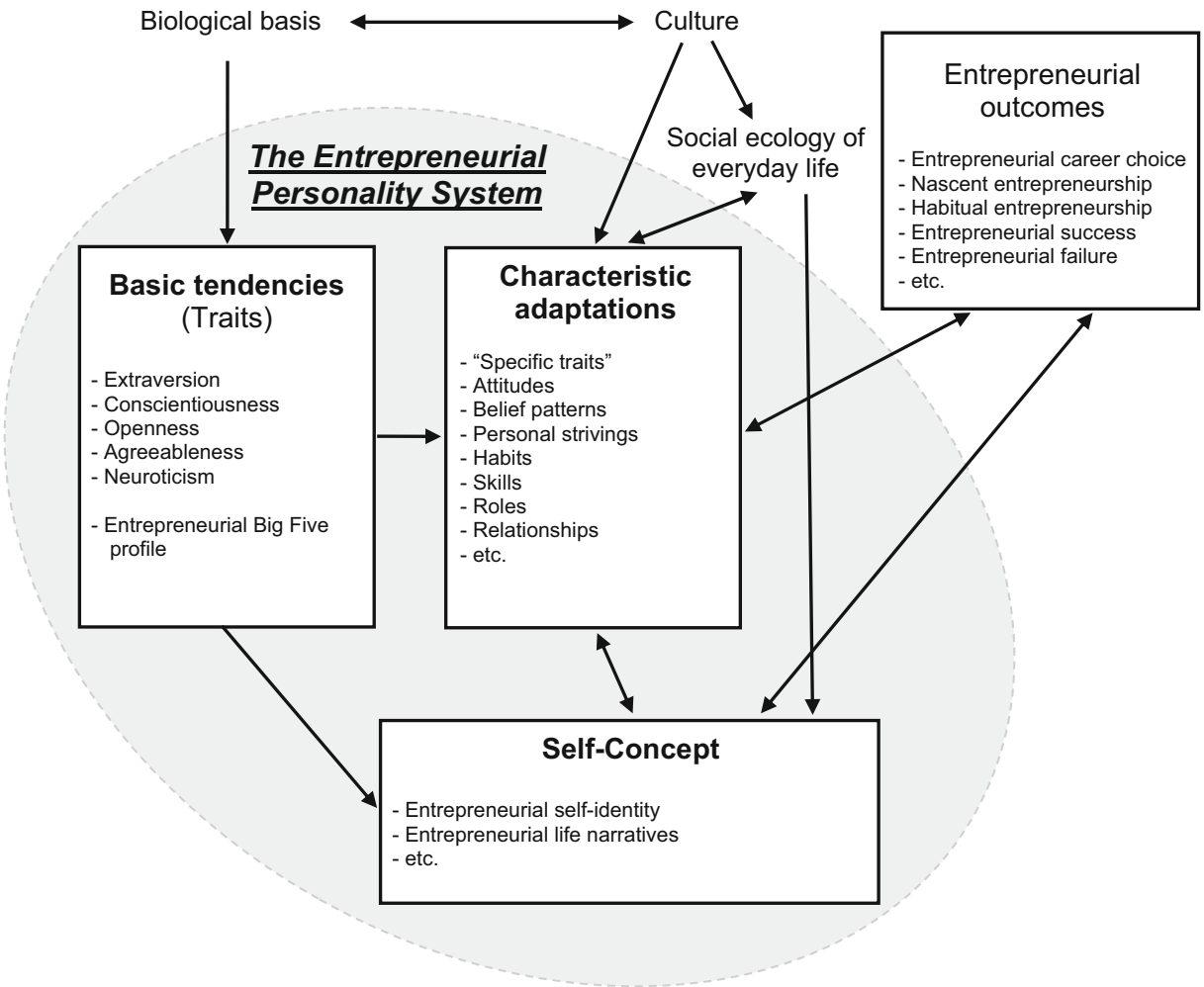

Fig. 1 The *Entrepreneurial Personality System (EPS)*. Adapted from the Five-Factor Theory (FFT) Personality System Model (McCrae and Costa 2008)

Characteristic adaptations are not necessarily seen as traits but as "specific motivational, social-cognitive, and developmental variables that are contextualized in time, situations, and social roles" (McAdams and Pals 2006, p. 212). Hence, these characteristic adaptations are the heading for a wide range of psychological characteristics, including very different subcomponents such as attitudes, habits, skills, roles, relationships, values, beliefs, interests, and cognitions. They are quite malleable over the life course, but they are also influenced by the relatively stable and biologically based basic tendencies level—the gravity effect of the Big Five traits. This gravity effect is reflected in the term "characteristic" because characteristic adaptations are the typical expression of the basic tendencies across time and situations. The term "adaptations" signals that they arise from ongoing interactions with the environment (e.g., ecology of everyday life which is nested in the wider cultural and societal context), guided by the individual character of the person and the developing self-concept (McCrae and Costa 2008).

According to the personality system framework (e.g., McAdams and Pals 2006; McCrae and Costa 2008), characteristic adaptations in the *EPS* refer to a wide range of more narrowly defined and changeable entrepreneurial characteristics such as self-efficacy, locus of control, and risk-taking (which in prior studies are often called specific entrepreneurial traits) but also entrepreneurial attitudes, values, motives, cognitions, and affect (e.g., entrepreneurial passion)—constructs that figure

prominently as proximal predictors in psychological models of entrepreneurial motivation, behavior, and success (e.g., Baum and Locke 2004; Cardon et al. 2009; Krueger 2007). At first sight, one might deem this characteristic adaptation level in the *EPS* a heterogeneous and unspecific category that lumps together very different psychological factors. Indeed such lumping together is simplistic and reductionistic since such a framework does not specify any dynamics *within* the characteristic adaptation level (e.g., between specific traits, attitudes, motives, cognitions, and affective states). However, the characteristic adaptations all have in common that they are influenced by the biologically based basic tendency level, the context, and the learning environment. Hence, the characteristic adaptations in the *EPS* "vary tremendously across cultures, families, and portions of the lifespan" (McCrae and Costa 2008, p. 164) because they not only develop out of the basic entrepreneurial tendencies but also in continuous interaction with the social ecology of everyday life (e.g., entrepreneurial stimulations via socialization experiences, education, work experiences, etc., Schmitt-Rodermund 2004, 2007) and the wider cultural setting (e.g., cultural norms and habits). The entrepreneurial characteristic adaptations affect entrepreneurial outcomes (e.g., entrepreneurial intentions, behaviors, and success) because they operate in the motivational, cognitive, and behavioral systems that initiate, navigate, and regulate entrepreneurial behavior.

Finally, the *self-concept* level in the *EPS* refers to an entrepreneurial self-concept (e.g., entrepreneurial self-identity and life narratives), as an evolving developmental construct in one's vocational development over the life course (Savickas 2002; Super 1963). It is characterized by a good fit between one's self-image and the entrepreneurial role. Often, entrepreneurship and related thinking patterns and behavior styles (e.g., creativity, personal initiative, leadership, competition, innovation) can be seen as some sort of a subjective life theme by these individuals in that personal decisions, thoughts, feelings, and activities across the different life stages may often involve some sort of entrepreneurial thinking and acting (e.g., age-appropriate entrepreneurial activities in childhood and adolescence, Schmitt-Rodermund 2004, 2007; entrepreneurial work and leisure activities during the working life; and active aging, Sullivan 2000). The entrepreneurial self-concept involves the individual subjective biography and is deeply rooted in early socialization experiences (e.g., identity theories in developmental psychology deem adolescence and early adulthood as crucial developmental phases in identity development, Arnett 2000; Grotevant 1987).

Within the *EPS*, the entrepreneurial self-concept develops out of both the basic tendencies and characteristic adaptations. Since it is an expression of the basic tendency level, there should also be a certain gravity effect of the Big Five traits. In line with this assumption, research showed that an intraindividual entrepreneurial Big Five profile predicts an entrepreneurial self-identity structure with regard to business idea generation and business founding (Obschonka et al. 2016b). Furthermore, the *EPS* model also assumes that the self-concept level feeds back to the characteristic adaptation level because it guides interactions with the environment (e.g., due to self-verification and self-determination motives, Deci and Ryan 2000). Moreover, external to the *EPS*, culture affects the self-concept via the proximal social ecology of everyday life (e.g., parenting and education practices, mass media, job experiences, the internalization of social roles, etc., Falck et al. 2012). Finally, the entrepreneurial self-concept stimulates entrepreneurial outcomes (e.g., choosing an entrepreneurial career due to a perceived good fit between entrepreneurship and one's occupational self-concept, Super 1963). In turn, entrepreneurial work experiences may also feed back to the entrepreneurial self-concept, for example via processes of occupational socialization (Frese 1982) and with regard to the development of a clearer sense of an entrepreneurial self-identity and biography (Hoang and Gimeno 2010; Johansson 2004). However, these processes should not be independent of the gravity effects of the basic tendency level. The following list summarizes the core assumptions of the *EPS* model.

4 Summary of the key propositions of the *Entrepreneurial Personality System* framework

1) *Person-oriented perspective*: The *EPS* functions as a whole (e.g., the whole is more than the sum of its parts). Hence, one cannot achieve a full understanding of the role of psychological aspects in entrepreneurship when not considering a person-oriented perspective that concentrates on the intraindividual dynamics within the *EPS* and between the *EPS* and its adjacent, outer levels (e.g., biology and context).
2) *Scope*: The *EPS* organizes a relatively large and diverse set of personal characteristics ranging from

the enduring core—a substantially biology-based component that is relatively stable over time and describes a person's basic entrepreneurial character (e.g., Big Five trait structure)—to more adaptive parts that are prone to considerable change due to their lifelong plasticity (characteristic adaptations, self-concept).

3) *Dynamics, coherence, and gravity effect*: The single parts of the *EPS* steadily interact with each other in a characteristic way over the life course, as described in Fig. 1. These interactions follow a certain coherence tendency of the individual personality structure within a person (e.g., *entrepreneurial* Big Five structure, *entrepreneurial* characteristic adaptations, and *entrepreneurial* self-concept). The enduring core establishes the foundation of the adaptive parts of the *EPS* in that it guides and directs the development of characteristic adaptations and the self-concept (gravity effect of broad traits). The enduring core thus canalizes (and even "dictates") the development of the adaptive parts of the EPS in a certain direction in the long run. External stimulation and learning (e.g., entrepreneurship education aiming to promote entrepreneurial attitudes, self-efficacy, and intentions) might be able to change the adaptive parts of the EPS in the short run, for example in a direction that deviates from the character of the enduring core, but it is likely that a certain gravity effect exerted by the enduring core produces a more stable long-term effect on the adaptive part (and the selection of environments that in turn shape the adaptive part) than these short-term stimulation and learning processes.
4) *Boundaries*: The *EPS* is bounded by its adjacent, outer levels: The individual's biological system (e.g., genes), proximal and distal ecology, and entrepreneurial agency (e.g., entrepreneurial thinking and acting) and experiences. These boundaries are permeable and fluid so that one can only come to a full understanding of the emergence, development, and functioning of the *EPS* when considering these adjacent levels too, which calls for *integrative* biological, contextual, developmental, and human agency perspectives in the study of the *EPS*.
5) *The term "traits"*: The term "traits" might be best used to describe the basic tendency level and thus the enduring core of the *EPS* (i.e., Big Five traits). Other more changeable personality characteristics such as need-for-achievement, self-efficacy, risk-taking, locus of control, passion, etc. might be better labeled as characteristic adaptations. This term reflects their considerable proneness to change—not independent of the basic tendency level, though, especially in the long run.
6) *The causal personality–entrepreneurial outcome relationship*: Personality does not affect entrepreneurial outcomes (e.g., entrepreneurial intentions, behavior, and success) in a purely deterministic way as a one-way street. Rather, the personality–entrepreneurial outcome relationship is much more dynamic and reciprocal, particularly with regard to the adaptive part of the *EPS*. There are ongoing transactions between the adaptive part and entrepreneurial outcomes (e.g., self-efficacy leads to success, which in turn promotes self-efficacy and so on). These transactions are affected by the basic tendency level (e.g., an entrepreneurial Big Five structure facilitates entrepreneurial adaptations in the adaptive part of the *EPS* during entrepreneurial work).

5 Examining the gravity effect of broad traits as hypothesized in the EPS

One core assumption of the *EPS* framework is the relationship between the basic tendency level and the characteristic adaptation level because the latter is not only a product of adaptation processes (e.g., learning, socialization) but also an expression of the person's character that guides these adaptation processes (McAdams and Pals 2006; McCrae and Costa 2008). Hence, there should be a gravity effect of the basic tendency level on the characteristic adaptation level. In the empirical part of this paper, we address this assumed gravity effect by focusing on the relationship between Big Five traits and the intraindividual entrepreneurial Big Five profile as the basic tendency level in the *EPS* and characteristic adaptations in the *EPS*, in our study risk-taking, self-efficacy, and internal locus of control. We study this relationship within a mediation model with the basic tendency level as independent variable, the characteristic adaptations as mediators, and entrepreneurial behavior (proxied by self-employment status) as outcome variable. Figure 2 illustrates this conceptual model to be tested in this study. With regard to the basic tendency level, we test two approaches against each

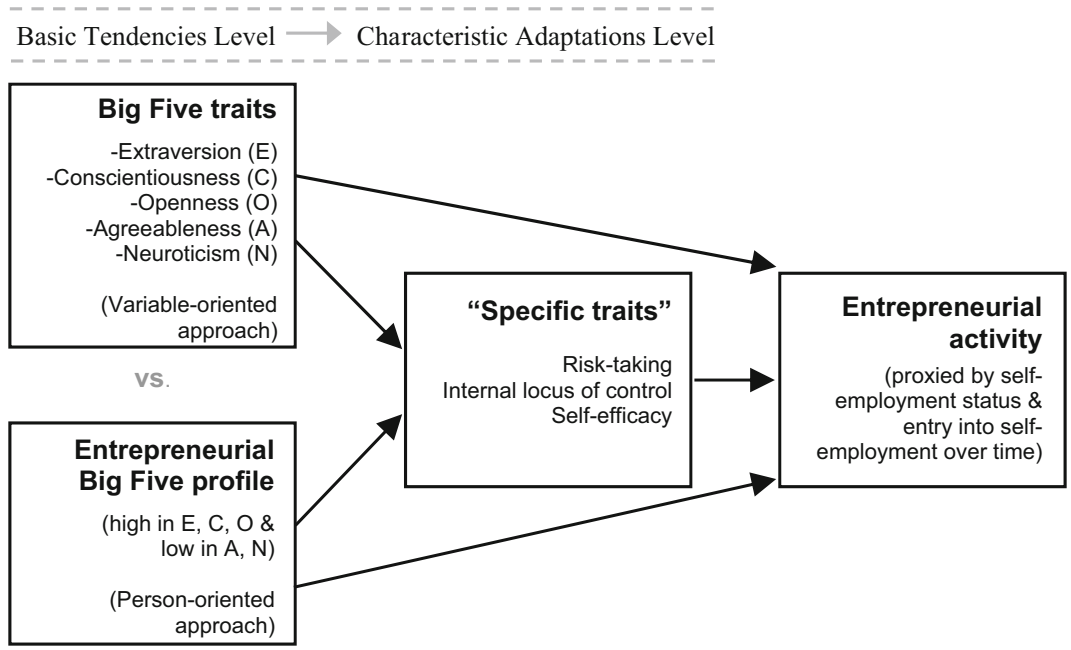

Fig. 2 Hypothesized model to be tested in this study. The model combines Big Five traits (single traits vs an intraindividual entrepreneurial Big Five profile) with "specific traits," as predicted in the *Entrepreneurial Personality System (EPS)*

other: the single Big Five traits vs the intraindividual entrepreneurial Big Five profile.

6 Method

We utilized data from three national longitudinal studies that included information on both the Big Five personality traits and a range of specific entrepreneurial traits. These studies are the "German Socio-Economic Panel" (GSOEP), the "Household, Income and Labour Dynamics in Australia" (HILDA) survey, and the "Midlife Development in the U.S." (MIDUS) study. The Big Five data from these studies have already been successfully utilized in a variety of studies, for example in developmental and personal psychology as well as in economics (e.g., Cobb-Clark and Schurer 2012; Donnellan and Lucas 2011; Graham and Lachman 2012; Heineck and Anger 2010; Keyes et al. 2002; Lucas and Donnellan 2011, 2009; Turiano et al. 2012). Their validity was proven in a variety of studies (e.g., Dehne and Schupp 2007). Also, the data on the specific traits such as locus of control, risk-taking, self-efficacy, and personal mastery and constraints were successfully applied in studies spanning a range of research fields (e.g., Specht et al. 2013; Caliendo et al. 2014; Cobb-Clark and Tan 2011; Lachman and Weaver 1998). In confirmatory factor analyses, we found support for the assumption that the Big Five traits and the specific traits are indeed independent constructs, which is in line with the earlier research (e.g., Dehne and Schupp 2007). These data sets also included information on self-employment which allowed the examination of mediation models with the specific traits as mediators between broad traits and entrepreneurial career choice, proxied by self-employment vs employed work as well as entry into self-employment over time.

6.1 Samples

The *German Socio-Economic Panel (GSOEP)* is a nationally representative study of private households in Germany which are followed over time (for details, see Wagner et al. 2007). The annual surveys cover topics such as household composition, education, employment, income, and well-being. For the analysis on the self-employment status, we used data from the 2005–2006 waves and focused on people within the 18–59 age group who were also part of the labor force (either

employed, self-employed, or unemployed) in 2006 and had complete information on all variables for our analysis (N = 10,079). Regarding the second analysis on entry into self-employment, we additionally used the 2007–2010 waves because we were interested in people who were not self-employed in 2006 but potentially entered self-employment in the next 4 years (2007–2010). Within this time frame, the sample was restricted to individuals who belonged to the 18–59 age group, were either employed or unemployed, and had no missing entries in the variables of interest (N = 5417).

The *Household, Income and Labor Dynamics in Australia (HILDA)* survey is a nationally representative longitudinal household-based study in Australia. The topics of the survey match those in the GSOEP. The sample restrictions are very similar to those for the German analyses. Regarding the analysis on the self-employment status, we utilized data from the 2005–2007 waves with a focus on individuals who were part of the labor force, belonged to the 18–59 age group in 2007, and had complete information on all variables for our analysis (N = 5535). For the analysis on entry into self-employment, we additionally considered the 2008–2011 waves and again focused on individuals who were not self-employed in 2007, but potentially became self-employed in the next 4 years (2008–2011). In this time span, the sample was limited to individuals with complete data sets on all relevant variables, who belonged to the 18–59 age group, and who were either employed or unemployed (N = 3489).

The *Midlife Development in the U.S. (MIDUS)* study is a two-wave national study in the USA managed by the MacArthur Foundation Research Network on Successful Midlife Development. As the study focuses on the midlife of individuals, the age of the respondents at wave 1 in 1995–1996 was 25–74 years. A second wave of data collection took place in 2004–2006. More details on the background and design of this study are provided elsewhere (Keyes et al. 2002; Turiano et al. 2012; Radler and Ryff 2010). In order to analyze the self-employment status in wave 1, we restricted the sample to individuals with complete data sets, who were part of the labor force and 59 years of age or younger (N = 4341). The second analysis regarding entry into self-employment focuses on those participants who were not self-employed in the first wave and could have become self-employed in wave 2.[1] For this analysis, the age and labor force restriction was enforced in both waves (N = 1970).

In order to achieve a chronological order between the Big Five traits, the characteristic adaptations, and individual entrepreneurial activity, we employed the following strategy. The starting point, denoted as T1, are the waves in which information on the Big Five traits was available in the longitudinal data sets (GSOEP 2005 wave, HILDA 2005 wave, MIDUS 1995–1996 wave). Characteristic adaptations were considered preferably from later waves. However, data availability (for locus of control in the GSOEP) and restrictions in the number of waves (MIDUS) force us to also consider characteristic adaptations from the same wave as the Big Five traits. The first entrepreneurship indicator, self-employment status, is from the same wave as the characteristic adaptation. The second entrepreneurship indicator captures entry into self-employment in a 4-year window after the measurement of the characteristic adaptations in the GSOEP and HILDA samples. An exception is the MIDUS sample, which has only two waves of data collection which are 10 years apart. Entry into self-employment is considered in the second wave of the MIDUS sample.

6.2 Measures

Big Five traits In the GSOEP T1 wave, respondents completed a 15-item version of the Big Five Inventory (BFI, John et al. 1991). Participants rated their personality characteristics using items such as "I see myself as someone who does a thorough job" (seven-point Likert scales: 1 = does not apply at all, 7 = fully applies). A detailed description of the scale and evidence for reliability and validity in the GSOEP data is provided in Donnellan and Lucas (2011) and Gerlitz and Schupp (2005). The means of the single Big Five traits were as follows: extraversion M = 4.89 (SD = 1.12, α = .66), conscientiousness M = 6.00 (SD = 0.86, α = .61), openness M = 4.54 (SD = 1.16, α = .60), agreeableness M = 5.42 (SD = 0.96, α = .50), and neuroticism M = 3.88 (SD = 1.21, α = .61).

In HILDA, a 36-item adjective-based measure of the Big Five was used in 2005 (T1). This adjective-based measure was developed from Saucier's (1994) Mini-

[1] As MIDUS has only two waves of data collection, the window of entry into self-employment is not four consecutive waves as in the HILDA and the GSOEP but refers only to wave 2.

Marker inventory. The response scale ranged from 1 (does not describe me at all) to 7 (describes me very well). Example adjectives are "talkative" and "bashful" for extraversion and "sympathetic" and "cooperative" for conscientiousness. Cobb-Clark and Schurer (2012) and Lucas and Donnellan (2009) provide extensive evidence for reliability and validity. Trait means were in 2005: extraversion: $M = 4.46$ ($SD = 1.06$, $\alpha = .77$); conscientiousness: $M = 5.06$ ($SD = 1.02$, $\alpha = .80$); openness: $M = 4.29$ ($SD = 1.03$, $\alpha = .75$); agreeableness: $M = 5.36$ ($SD = 0.89$, $\alpha = .78$); neuroticism: $M = 1.93$ ($SD = 1.05$, $\alpha = .80$).

In the MIDUS, the US data set, respondents completed a 25-item adjective-based measure of the Big Five that was selected from previous Big Five questionnaires (e.g., John et al. 1991). Examples of those adjectives are "creative" and "imaginative" for openness and "warm" and "helpful" for agreeableness. The response scale ranged from 1 (does not describe me at all) to 4 (describes me very well). This measure has been validated, correlates with NEO traits scales, and shows high internal reliability coefficients (e.g., Keyes et al. 2002; Turiano et al. 2012). We use Big Five data from the MIDUS T1 wave. Means of the traits were as follows: extraversion: $M = 3.19$ ($SD = 0.55$, $\alpha = .78$); conscientiousness: $M = 3.43$ ($SD = 0.44$, $\alpha = .57$); openness: $M = 3.04$ ($SD = 0.52$, $\alpha = .78$); agreeableness: $M = 3.46$ ($SD = 0.50$, $\alpha = .81$); neuroticism: $M = 2.26$ ($SD = 0.66$, $\alpha = .75$).

Please note that sometimes the reliability coefficients reported here (Cronbach's α) are somewhat low—but this is a well-known phenomenon in these data sets and mostly due to the short questionnaires used (e.g., three items per trait in the GSOEP; Gerlitz and Schupp 2005). The reliability and validity of these measures are well-established.

Entrepreneurial Big Five profile To quantify the profile, we applied the same fit measure as in the previous research (Obschonka et al. 2013, 2014). This fit measure, which summarizes the single traits into one index, is comparable to Cronbach and Gleser's D^2, which is a leading profile similarity measure in psychological research. By means of a fixed reference profile with extreme values as endpoints of the distributions (highest possible value in E, C, and O, lowest possible value in A and N), the individual deviation from these statistical endpoints is assessed for each person as D^2. As discussed elsewhere (Obschonka et al. 2013), one must acknowledge that this is a relatively broadly defined measure (e.g., it does not look at the concrete shape of the empirical profile, for example if extraversion is higher than openness). There are no concrete theoretical and empirical reasons, however, for using other reference profiles.

In a first step, we recoded the original item scales from 1 to 7 into 0–6 in the GSOEP and HILDA data and from 1 to 4 to 0–3 in the MIDUS data. In a second step, we calculated the fit between the individual's Big Five profile and the theoretical reference values, which are defined by the highest point of the scales (6 in GSOEP and HILDA and 3 in MIDUS) for extraversion, conscientiousness, and openness as well as the lowest point of the scales (0) for agreeableness and neuroticism. To this end, we computed the squared differences between the individual's value on each of the five scales and the theoretical reference value. For example, for a person scoring 4 in openness in the GSOEP sample, the squared difference from the reference value 0 would be 16. In a third step, all five squared differences were then summed up for each individual, and the algebraic sign was reversed (e.g., value of 25 became −25). The resulting value served as the final variable of the entrepreneurial Big Five profile (GSOEP: $M = -44.99$, $SD = 14.15$, HILDA: $M = -45.39$, $SD = 11.52$, MIDUS: $M = -10.99$, $SD = 3.19$). The last step ensured that a higher value (closer to 0) of the entrepreneurial Big Five profile represents a better fit of a person's Big Five profile with the theoretical reference profile. More information on this profile measure is provided elsewhere (Obschonka et al. 2013).

Locus of control In the German GSOEP, ten items based on Rotter (1966) are used to capture locus of control in 2005 (T2). Participants indicated their agreement to questions such as "How my life goes depends on myself" on a seven-point Likert scale (1 = does not apply at all, 7 = fully applies). A factor analysis reveals one common factor underlying the ten items. However, three of the ten items have loadings on the factor of close to zero. We thus followed Specht et al. (2013) by basing the locus of control construct on the remaining seven items (Cronbach $\alpha = .69$).[2] The mean of these items

[2] Others identify a two-factor solution where two to three items load on a factor that can be labeled as internal locus of control and six items loading on a factor that can be labeled as external locus of control (e.g., Caliendo et al. 2010).

then served as the final variable for the locus of control (M = 4.76, SD = .94, α = .69).

Risk-taking Another characteristic entrepreneurial adaptation included in the GSOEP is risk-taking (T1). Risk-taking is measured by a single item indicating the general willingness to take risks ("Are you generally a person who is fully prepared to take risks or do you try to avoid taking risks?"). Respondents answered this question on a scale ranging from 0 (fully unwilling to take risks) to 10 (fully willing to take risks). The descriptive statistics for risk-taking were M = 5.03 (SD = 2.15).

Self-efficacy A seven-item battery based on Pearlin and Schooler (1978) intended to measure self-efficacy is part of the 2007 wave of the Australian HILDA data set (T3). Respondents were asked to indicate how much they agreed or disagreed with statements such as "I can do just about anything I really set my mind to do" on a seven-point Likert scale (1 = strongly disagree to 7 = strongly agree). The mean of these seven items served then as the final variable for self-efficacy (M = 5.49, SD = 1.02, α = .83).

Personal mastery In MIDUS, four items measured personal mastery in T1 (e.g., "When I really want to do something, I usually find a way to succeed at it"). A seven-point Likert scale was used (1 = strongly agree to 7 = strongly disagree). According to Lachman and Weaver (1998, p. 765), personal mastery "refers to one's sense of efficacy or effectiveness in carrying out goals." The literature sometimes regards personal mastery as a self-efficacy belief. In order to create the personal mastery measure, the values of the items were reverse-coded so that higher values reflected greater personal mastery beliefs. The mean of the four items then served as final variable (M = 5.89, SD = .96, α = .69).

Personal constraints MIDUS also contains an item battery for personal constraint beliefs in T1. The personal constraint construct can be regarded as a locus of control belief as it "indicates to what extent one believes that there are obstacles or factors beyond one's control that interfere with reaching goals" (Lachman and Weaver 1998, p. 765). The eight items (e.g., "There is really no way that I can solve the problems I have," seven-point Likert scale from 1 = strongly agree to 7 = strongly disagree). Again, the values of the items were reverse-coded so that higher values reflected greater belief in personal constraints. The mean of the four items then served as final variable (M = 2.58, SD = 1.18, α = .85).

Self-employment status The first indicator of entrepreneurial outcomes is a snapshot of whether an individual is self-employed or not at a certain point in time. In order to predict self-employment status, we compare self-employed individuals with employed and unemployed individuals. This comparison reflects the state of knowledge in labor economics that beside the usual distinction between wage work and self-employment, individuals also sometimes face periods of involuntary unemployment (Åstebro et al. 2011). Thus, the variable self-employment status is a binary variable which takes the value of 1 if the individual is self-employed and 0 if the individual is either employed in wage work or unemployed but looking for work. Note, however, that the results of the analysis below remain the same when using a more traditional vocational choice definition of self-employed vs employed. Data on the self-employment status are from the same wave as the characteristic adaptations. Of the wave 2 sample in GSOEP, 989 individuals reported self-employment in 2006 (individuals helping in family businesses were not considered self-employed; Fritsch and Rusakova 2005). This represents 9.81% of the sample. The respective numbers were 791 self-employed in the Australian HILDA data set (again excluding unpaid family workers but including those who are employees of their own business, which is another legal construction for self-employment), which amounts to 14.29% self-employment in our sample. In the MIDUS wave 1 data, 683 individuals are recorded as self-employed (15.73% of the sample).

Entry into self-employment In contrast to self-employment status at one point in time, the second indicator of entrepreneurial outcomes captures the entry of individuals into self-employment from a process perspective (Caliendo et al. 2014). The respective binary variable takes the value of 1 if individuals who are not self-employed at a certain point in time (GSOEP T2, HILDA T3, MIDUS T1) entered self-employment in a later wave or waves (GSOEP T3–T6, HILDA T4–T7, MIDUS T2). The variable takes the value of 0 if individuals who are not self-employed at this certain point in time do not become entrepreneurs; the variable is coded as

missing for those respondents who were already self-employed at the first point in time. Within the 4-year window, 193 respondents in the GSOEP (3.47% of the respective sample) and 268 respondents of the HILDA sample entered self-employment (7.68% of the respective sample). In the MIDUS data set, 175 respondents who were not self-employed in T1 were self-employed in T2 (8.88% of the sample).

Control variables Empirical results from many papers show that the sociodemographic variables *age*, *gender*, and *education* are strong predictors for self-employment (e.g., Holtz-Eakin et al. 1994; Obschonka et al. 2014; Blanchflower 2000). Thus, these variables are included as controls in our analysis. Regarding age and education, we consider curvilinear effects as self-employment seems to be less likely at both tails of the age distribution (Holtz-Eakin et al. 1994) and more likely at both tails of the education distribution (Blanchflower 2000). In more detail, age and age^2 at T1 in the GSOEP, HILDA, and MIDUS samples are included in the regressions. We also include length of education (in years) and length of education^2 until T1 in all three samples. Note that the variable "years of education" is available in the GSOEP. A similar variable is, however, not readily available in HILDA and MIDUS but was computed from the highest level of education for each respondent (e.g., high school degree = 12 years of education, see Stuetzer et al. 2013, for a similar approach). Gender is operationalized as a dummy variable (1 = male, 0 = female).

6.3 Empirical strategy and statistical methods

In this paper, we employ the following empirical strategy. In a first step, we test for the effect of the Big Five traits on the self-employment status and entry into self-employment. As self-employment and entry are binary variables, we used logistic regression. This analysis provides baseline results for our further analysis. In a second step, we test the relationship between the Big Five traits and its entrepreneurial constellation (entrepreneurial Big Five profile) with the characteristic adaptations. To this end, ordinary least squares (OLS) regressions are employed. This analysis is the center of our analytical strategy and provides the answer to the most important research question in this paper, namely whether or not the basic tendencies (Big Five) predict the characteristic adaptations (e.g., self-efficacy). In a third step, we test for mediated effects of the Big Five traits and the entrepreneurial Big Five profile on self-employment status and entry via the characteristic adaptations. In order to test for mediation (MacKinnon et al. 2007), the STATA binary mediation macro for assessing indirect effects in multiple mediator models was used. Bootstrap confidence intervals for the indirect effects (with 1000 resamples) of each mediator in the models were estimated. An important advantage of the macro with respect to our analysis is that it can deal with both continuous and binary-dependent variables. In order to allow comparison across models and samples, we z-standardize all personality variables (the Big Five traits and the entrepreneurial Big Five profile as well as the characteristic adaptations).

7 Results

In what follows, we present the results for each of the national samples separately (see Figs. 3, 4, 5, 6, 7, and 8). Although our main focus is on the relationship between the Big Five level and the characteristic adaptations level, and not so much on the relationship between the personality characteristics and entrepreneurial outcomes (a relationship that has been studied extensively in the past), we report our results in the "traditional" way of a mediation analysis. Thus, we present (1) the results of the relationship between the Big Five level and entrepreneurial outcomes, (2) the results of the relationship between the Big Five level and the characteristic adaptations as well as their relationship with the entrepreneurial outcomes, and (3) the indirect effect of the Big Five level via the characteristic adaptation on the entrepreneurial outcomes. Thereafter, similarities and differences of the findings between the variable-oriented and person-oriented approach are discussed. Finally, we present some robustness checks.

7.1 German Socio-Economic Panel

As illustrated in Fig. 3 (model 1a), extraversion ($B = .16$, $SE = .04$, $OR = 1.17$, $p < .001$) and openness ($B = .33$, $SE = .04$, $OR = 1.39$, $p < .001$) predicted self-employment status in the GSOEP. Not surprisingly, people with higher openness and extraversion were more often self-employed. Contrary to expectations, conscientiousness negatively predicted self-employment status ($B = -.09$, $SE = .04$, $OR = 0.91$

$p < .01$). Agreeableness and neuroticism did not predict self-employment status. In model 1b, we turn our attention to the relationship between the Big Five traits and the two characteristic adaptations in the GSOEP: locus of control and risk-taking. OLS regressions reveal that extraversion ($B = .12$, $SE = .01$, $p < .001$), conscientiousness ($B = .12$, $SE = .01$, $p < .001$), and agreeableness ($B = .06$, $SE = .01$, $p < .001$) positively predicted locus of control. Openness ($B = -.03$, $SE = .01$, $p < .001$) and neuroticism ($B = -.28$, $SE = .01$, $p < .001$) negatively predicted locus of control. Risk-taking was positively predicted by extraversion ($B = .14$, $SE = .01$, $p < .001$) as well as openness ($B = .14$, $SE = .01$, $p < .001$) and negatively predicted by agreeableness ($B = -.08$, $SE = .01$, $p < .001$) as well as neuroticism ($B = -.10$, $SE = .01$, $p < .001$). Conscientiousness did not predict risk-taking. In turn, locus of control ($B = .23$, $SE = .04$, $OR = 1.25$, $p < .001$) and risk-taking ($B = .41$, $SE = .04$, OR =1.51, $p < .001$) positively predicted self-employment status. Regarding the potential mediated effect of the Big Five traits via the characteristic adaptations on self-employment status, we only consider extraversion, conscientiousness, and openness because agreeableness and neuroticism had no direct relationship with the self-employment status (so, there is no effect to be mediated according to Baron and Kenny 1986). Regarding conscientiousness, we only consider the relationship through locus of control as there was no significant relationship between conscientiousness and the mediator risk-taking. The indirect effect of extraversion on self-employment status through locus of control was .01 ($SE = .00$, 95%CI = .01 and .02) and the effect through risk-taking was .03 ($SE = .00$, 95%CI = .02 and .04). The indirect effect of consciousness on self-employment status through locus of control was .01 ($SE = .00$, 95%CI = .01 and .02). Finally, the indirect effect of openness on self-employment status through locus of control was −.001 ($SE = .00$, 95%CI = −.01 and −.00) and the effect through risk-taking was .03 ($SE = .00$, 95%CI = .02 and .04). Note, however, that only if the 95%CI does not include 0—indicated by the same sign for the lower and the upper boundary—is the indirect effect significant. Applying this criterion, the effect of extraversion of self-employment is mediated via locus of control and risk-taking. More precisely, the effect is fully mediated as the direct effect of extraversion on self-employment turned insignificant when the mediator variable was included in the model. Additionally, the effect of openness on self-employment is mediated by risk-taking. The nature of this mediation is partial because there remains a significant correlation between openness and self-employment when the mediator variable is included in the regression. Note that the indirect effects of conscientiousness and openness on self-employment via locus of control are in the opposite direction than the direct effect, which suggests a suppression effect, which is usually hard to interpret.

When using entry into self-employment as an alternative dependent variable, some results change (models 1c and 1d). Among the Big Five traits, only openness still predicts self-employment ($B = .32$, $SE = .08$, $OR = 1.38$, $p < .001$). Although the Big Five traits still predict locus of control in the same pattern as described above, locus of control did not predict entry into self-employment. Unchanged from above are the relationships of the Big Five traits with risk-taking and the relationship between risk-taking and entrepreneurship. However, we find empirical evidence for only one significant mediation effect, that is between openness and entry via risk-taking (indirect effect = .03, $SE = .01$, 95%CI = .02 and .05).

We then tested the entrepreneurial Big Five profile, instead of the single traits, as independent variable (Fig. 4). The profile positively predicted self-employment status (model 2a, $B = .28$, $SE = .04$, $OR = 1.32$, $p < .001$). As displayed in model 2b, the profile also positively predicted locus of control ($B = .20$, $SE = .01$, $p < .001$), which in turn predicted self-employment ($B = .17$, $SE = .04$, $OR = 1.19$, $p < .001$). In addition, the profile predicted risk-taking ($B = .27$, $SE = .01$, $p < .001$), which in turn predicted self-employment status ($B = .45$, $SE = .04$, $OR = 1.56$, $p < .001$). Testing for the indirect effects reveals that both locus of control (indirect effect = .02, SE = .00, 95%CI = .01 and .03) and risk-taking (indirect effect = .06, $SE = .01$, 95%CI = .05 and .07) partially mediated the effect of the profile on self-employment status. When looking at entry as alternative dependent variable in models 2c and 2d, most of these results are confirmed. The only exception is that locus of control no longer predicts entry, which in turn rules out a mediation effect via this path.

7.2 Household, Income and Labor Dynamics in Australia survey

In Australia (model 3a in Fig. 5), as expected, extraversion ($B = .12$, $SE = .04$, $OR = 1.13$, $p < .01$) and

openness (B = .20, SE = .04, OR = 1.22, p < .001) positively predicted self-employment status, while conscientiousness (B = −.09, SE = .04, OR = .92, p < .05) negatively predicted self-employment status. However, agreeableness and neuroticism did not predict self-employment status. The main analysis in model 3b reveals that, as expected, extraversion (B = .13, SE = .01, p < .001), conscientiousness (B = .11, SE = .01, p < .001), and neuroticism (B = −.23, SE = .01, p < .001) predicted self-efficacy, which in turn positively predicted an individual's self-employment status (B = .14, SE = .05, OR = 1.15, p < .01). Contrary to expectations, agreeableness positively predicted self-efficacy (B = .05, SE = .01, p < .001) while openness did not predict self-efficacy. Regarding the potential indirect effect of the Big Five traits via the characteristic adaptations on self-employment status, we only consider extraversion and conscientiousness. Agreeableness and neuroticism did not meet the necessary condition of a direct relationship with self-employment status, and openness did not predict the potential mediator self-efficacy. The indirect effect of extraversion was .01 (SE = .00, 95%CI = .00 and .02), which suggests (together with the still significant relationship of extraversion and self-employment) partial mediation. The indirect effect of conscientiousness was .01 (SE = .00, 95%CI = .00 and .01). Note, however, that the indirect effects of conscientiousness on self-employment via self-efficacy are in the opposite direction than the direct effect, which suggests a suppression effect. When looking at entry into self-employment as alternative dependent variable, the results remain largely unchanged. The few changes are as follows: Conscientiousness does not predict entry, but there is now the expected negative relationship between neuroticism and self-efficacy (B = −.17, SE = .84, OR = .84, p < .05). Moreover, self-efficacy does not predict entry (3C and 3D).

Again, we repeated the analysis with the entrepreneurial Big Five profile instead of the individual Big Five traits as independent variable. The results of this analysis are depicted in Fig. 6. Model 4a shows that the profile positively predicted self-employment status (B = .15, SE = .04, OR = 1.16, p < .001). In addition, the profile positively predicted self-efficacy (model 4b, B = .19, SE = .01, p < .001), which in turn predicted self-employment status (B = .11, SE = .05, OR = 1.12, p < .05). Finally, the indirect effect of the profile via self-efficacy was .01 (SE = .00, 95%CI = .00 and .02). Together with the still positive and significant relationship between the profile and self-employment, this suggests partial mediation. Repeating the analysis with entry into self-employment as dependent variable (models 4c and 4d) provides the same pattern of results, but again with the exception of the non-significant relationship between self-efficacy and entry.

7.3 The Midlife Development in the U.S. study

As illustrated in Fig. 7 (model 5a), openness (as expected) positively predicted the self-employment status in the USA (B = .21, SE = .05, OR = 1.24, p < .01), and agreeableness (as expected) negatively predicted the self-employment status (B = .11, SE = .05, OR = .90, p < .05) while the other Big Five traits were not related to self-employment. However, all Big Five traits were related to the characteristic adaptations: personal mastery and personal constraints. As expected and displayed in model 5b, extraversion (B = .17, SE = .02, p < .001), conscientiousness (B = .15, SE = .01, p < .001), and openness (B = .17, SE = .02, p < .001) positively predicted personal mastery, while agreeableness (B = −.03, SE = .02, p < .05) and neuroticism (B = −.18, SE = .01, p < .001) negatively predicted personal mastery. With respect to personal constraints, extraversion (B = −.16, SE = .02, p < .001), conscientiousness (B = −.18, SE = .01, p < .001), and openness (B = −.07, SE = .02, p < .001) negatively predicted personal constraints, while agreeableness (B = .05, SE = .02, p < .001) and neuroticism (B = .32, SE = .01, p < .001) positively predicted personal constraints, which confirms our expectations. Neither characteristic adaptation predicted an individual's self-employment status. Consequently, there can be no mediated relationship between the Big Five traits and self-employment status via personal mastery and personal constraints. When looking at entry as the alternative indicator for entrepreneurship, the results remain largely unchanged (models 5c and 5d).

In the second step, we again repeated the analysis with the Big Five profile, which positively predicted self-employment (model 6a in Fig. 8, B = .12, SE = .05, OR = 1.13, p < .01). More importantly, the profile also positively predicted personal mastery (model 6b, B = .31, SE = .01, p < .001), which in turn predicted self-employment (B = .12, SE = .05, OR = 1.13, p < .05). Moreover, the profile also negatively predicted personal constraints (B = −.38, SE = .01, p < .001), which,

however, did not predict the self-employment status. Given these results, we tested for a mediated relationship of the profile via personal mastery on self-employment status. The indirect effect in this mediation model was .02 (*SE* = .01, 95%CI = .00 and .04). As the direct relationship between the profile and self-employment turned insignificant, this indicates full mediation of the profile–self-employment link via personal mastery. When looking at entry as an alternative entrepreneurship indicator (models 6c and 6d), the results remain largely unchanged. The only exception is that personal mastery no longer predicts entry, which of course also rules out mediation.

7.4 Summary of mediation results

Tables 1 and 2 provide an overview of the central findings in the three national samples. Summarizing the relationship between the single Big Five traits and the characteristic adaptations reveals a somewhat inconsistent picture, as shown in the right part of Table 1. While extraversion and neuroticism delivered results which were expected by our theoretical reasoning, there were some inconsistencies regarding the other three Big Five traits. Regarding possible mediation effects, as summarized in Table 2, only sometimes was the effect of one of the single Big Five traits on entrepreneurship mediated by the characteristic adaptations (five out of 50 possible mediation effects[3]).

These inconsistent variable-oriented results are in contrast to the results delivered by the entrepreneurial Big Five profile. In all three samples, the entrepreneurial Big Five profile predicted the characteristic adaptations as suggested by theory (positive relationship with locus of control, risk-taking, self-efficacy, and personal mastery and a negative relationship with personal constraints). In other words, this is a clear indication of a gravity effect of the basic entrepreneurial character of a person on the adaptive parts of the EPS (here, characteristic adaptations). As noted earlier, prior research already indicated a gravity effect of the entrepreneurial Big Five profile on entrepreneurial self-concept, another part of the adaptive components in the EPS (Obschonka et al. 2016b).

Also, when looking at mediation effects, the profile outperforms the single Big Five traits. Quite regularly, the effect of the profile on entrepreneurship was mediated by the characteristic adaptations (five out of ten possible mediation effects). However, the single Big Five traits outperform the entrepreneurial Big Five profile in terms of R^2 in the regressions, which is a typical result in such head-to-head comparisons of a variable- vs person-oriented approach (Asendorpf 2003). As stressed by Asendorpf, the better variance explanation might be due to the higher number of predictors (e.g., five Big Five traits instead of a single profile index), so that it might not indicate a better validity and meaningfulness of the variable-oriented results. Taken together, the answer to the first two questions largely depends whether one applies a person- or a variable-oriented approach. The part of the *EPS* model studied here received full support with regard to the person-oriented approach of assessing entrepreneurial basic tendencies.

7.5 Robustness checks

We conducted several robustness checks regarding the effects of the entrepreneurial Big Five profile.[4] We started by checking whether the results might be affected by the D^2 profile similarity method of assessing the entrepreneurial Big Five profile. To this end, we used a simple composite score by adding the mean scores for extraversion, conscientiousness, and openness while subtracting mean scores of agreeableness and neuroticism for each respondent. We expect the same set of results regarding the effects of the profile on entrepreneurship and the characteristic adaptations, and indeed, the results did not differ substantially from the findings reported above.

Following earlier research on the entrepreneurial Big Five profile (Obschonka et al. 2013), we also tested the entrepreneurial personality profile

[3] The number of possible mediation effects in the case of the Big Five traits can be calculated as follows: number of Big Five traits * number of dependent variables * number of characteristic adaptations for each sample (GSOEP = 20, HILDA = 10, MIDUS = 20 possible mediation effects).

[4] The results of these robustness checks are available from the authors on request.

Table 1 Gravity effects of personality traits

	Direct effect of Big Five traits and the entrepreneurial Big Five profile on entrepreneurial career choice (without mediators) and effects of specific traits on entrepreneurial career choice						Effect of Big Five traits and the entrepreneurial Big Five profile on specific traits				
	DV: Self-employment			DV: Entry			DV: Locus of control	DV: Risk-taking	DV: Self-efficacy	DV: Personal mastery	DV: Personal constraints
	GSOEP	HILDA	MIDUS	GSOEP	HILDA	MIDUS	GSOEP	GSOEP	HILDA	MIDUS	MIDUS
Predictors:											
Extraversion	+	+	ns	ns	+	ns	+	+	+	+	−
Conscientiousness	−	−	ns	ns	ns	ns	+	ns	+	+	−
Openness	+	+	+	+	+	ns	−	+	ns	+	−
Agreeableness	ns	ns	−	ns	ns	ns	+	−	+	−	+
Neuroticism	ns	ns	ns	ns	−	ns	−	−	−	−	+
Entrepreneurial Big Five profile	+	+	+	+	+	+	+	+	+	+	−
Internal locus of control	+			ns							
Risk-taking	+			+							
Self-efficacy		+			ns						
Personal mastery			ns			ns/+					
Personal constraints			ns			ns					

Note. Results are taken from the regressions displayed in Figs. 3–8. "+" = positive relationship, significant at least at the 5% level; "−" = negative relationship, significant at least at the 5% level; *ns* no significant relationship, *DV* dependent variable, *GSOEP* German Socio-Economic Panel, *HILDA* Household, Income and Labor Dynamics in Australia study, *MIDUS* The Midlife Development in the US study

The consistent gravity effect of the entrepreneurial Big Five profile is in bold

Table 2 Overview of mediation effects

	Mediation effects of Big Five traits and the entrepreneurial Big Five profile on entrepreneurial career choice with specific traits as mediators									
	DV: Self-employment					DV: Entry				
	Mediator: Locus of control (GSOEP)	Mediator: Risk-taking (GSOEP)	Mediator: Self-efficacy (HILDA)	Mediator: Personal mastery (MIDUS)	Mediator: Personal constraints (MIDUS)	Mediator: Locus of control (GSOEP)	Mediator: Risk-taking (GSOEP)	Mediator: Self-efficacy (HILDA)	Mediator: Personal mastery (MIDUS)	Mediator: Personal constraints (MIDUS)
Predictors:										
Extraversion	+	+	+	nc	nc	nc	nc	nc	nc	nc
Conscientiousness	s	nc	s	nc	nc	nc	nc	nc	nc	nc
Openness	s	+	nc	nc	nc	nc	+	nc	nc	nc
Agreeableness	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
Neuroticism	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
Entrepreneurial Big Five profile	+	+	+	+	nc	nc	+	nc	nc	nc

Note. "+" = positive mediation effect, significant at least at the 5% level; "–" = negative mediation effect, significant at least at the 5% level; *ns* no significant mediation effect, *s* suppression effect, *nc* not considered, because of no direct effect of the IV on the DV or no effect of the IV on the mediator, *DV* dependent variable, *GSOEP* German Socio-Economic Panel, *HILDA* Household, Income and Labor Dynamics in Australia study, *MIDUS* The Midlife Development in the US study

against two "neutral" profiles. In contrast to the entrepreneurial Big Five profile, these neutral profiles should yield non-meaningful results because there is no underlying theory substantiating an effect of such neutral profiles. We computed the first neutral profile as a neutral D^2 profile utilizing each individual's difference from the *middle values of the Big Five Likert scales* (how strongly a person's empirical Big Five profile deviates from a fixed reference profile characterized by the simple middle values of the Big Five scales (e.g., a scale between 1 and 5 has a middle value of 3). The second version of the neutral profile builds on each individual's D^2 deviation from the *mean values* of the empirical distribution of the Big Five traits as fixed reference values. The second neutral profile then represents each individual's difference from the average *empirical* Big Five scores of the whole sample in each data set (and not from the middle scale values like in the other "neutral" profile). Both neutral profiles delivered non-meaningful results, which were not backed up by our theoretical reasoning (quite often, the neutral profiles negatively predicted entrepreneurial outcomes and the characteristic adaptations).

8 Discussion

This paper was motivated by a person-oriented perspective trying to capture the individual personality as a dynamic system, and thus the "reality" of an individual as a whole. Our main goal was to connect the biological level that is highly relevant in entrepreneurship (Nicolaou et al. 2008) to the psychosocial levels such as the characteristic adaptations within the entrepreneurial mindset.

In the first part of the paper, we presented a new framework model describing the components of, and the dynamics within, entrepreneurial individuals. Based on advances in personality research that seeks to structure (the interplay of) personality components within the individual, we follow the *FFT Personality System* model (McCrae and Costa 2008) and present an integrative model of the *Entrepreneurial Personality System (EPS)*. This framework attempts to connect the different levels and components of an entrepreneurial personality, from biologically based basic tendencies like the Big Five traits towards the more malleable characteristic adaptations and the developing self-concept (Fig. 1). We thus contribute to a more holistic understanding of the entrepreneurial personality by trying to connect otherwise loose ends in the literature.

The *EPS* framework also offers an integrative perspective on some of the current "hot spots" in entrepreneurship research, for example research on entrepreneurial orientation (Lumpkin and Dess 1996), entrepreneurial passion (Cardon et al. 2009), and entrepreneurial cognitions (e.g., entrepreneurial alertness, Hisrich et al. 2007), which, according to the *EPS* framework, are mainly characteristic adaptations and thus the result of basic tendencies *and* adaptation processes over time (and of the systematic interplay between basic tendencies, the self-concept, and contexts). Another hot spot is identity research (Fauchart and Gruber 2011; Hoang and Gimeno 2010), and here, the *EPS* framework provides a theory-driven integration of self-concept aspects like identity into a biopsychosocial framework. In other words, the EPS framework offers a new perspective on the emergence and development (and shaping) of such characteristic adaptations and entrepreneurial identity. Finally, the *EPS* framework also speaks to other hot spots that are more at the outer levels of the *EPS*, namely biology (Nicolaou and Shane 2014) and cultural and regional factors (Hopp and Stephan 2012).

We also have to stress that the EPS framework model might have important limitations and certain boundary conditions could play role. For example, the model should be more predictive of those entrepreneurial outcomes that are indeed affected by the entrepreneurial mindset (e.g., entrepreneurial career choice, venture creation success, entrepreneurial performance), compared to other outcomes that are mainly shaped by external factors. Moreover, moderators, or boundary conditions, could play a role, for example team founder vs single founder. Finally, one could discuss whether and how the entrepreneurial mindset shapes then strategic posture of firms.

The second main contribution of this paper is the new empirical evidence on the link between the entrepreneurial basic tendencies and characteristic adaptations within the *EPS*, as hypothesized

in the *FFT Personality System* model (McCrae and Costa 2008). We did not study the other aspects of the EPS framework (e.g., self-concept) in this analysis because the data sets we used did not include relevant information in this regard. We found a positive relationship between the entrepreneurial Big Five profile and each of the characteristic entrepreneurial adaptations studied, which is in line with the assumed gravity effect of the basic tendency level. Following the logic of the *EPS* framework, it is remarkable to find such substantial relationships despite disregarding the ecology (and self-concept aspects) that should also form and shape the characteristic adaptations. This may illustrate the "power" of the enduring core of the *EPS* in influencing and navigating the adaptive parts of the *EPS* and thus (indirectly) entrepreneurial outcomes. This would concur with the general "power of personality" as described in the research in personality psychology (Roberts et al. 2007), for example in the examination of work-related consequences of a basic personality level (Barrick and Mount 1991). The basic tendency level might be the "starting point" of the person's vocational development towards an entrepreneurial mindset in adulthood (Schmitt-Rodermund 2004), and it might also exert a substantial and enduring gravity effect in the vocational development over the life span by guiding and influencing the development of entrepreneurial characteristic adaptations and the entrepreneurial self-concept across childhood, adolescence, and adulthood (Obschonka and Silbereisen 2012). Finally, this result on the gravity effect could help to better understand the findings from genetic studies indicating a substantial biological basis behind entrepreneurial behavior (Nicolaou et al. 2008; Nicolaou and Shane 2014).

What are the implications for research and practice? Clearly, one important implication concerns the field of entrepreneurial education. Entrepreneurship programs (e.g., entrepreneurship courses in universities) often aim at improving entrepreneurial characteristic adaptations, for example motivational constructs such as entrepreneurial attitudes and self-efficacy beliefs but also entrepreneurial skills and cognitions. According to the *EPS* framework, such programs may want to keep in mind that learning and adaptation processes involving these characteristic adaptations (and occasionally also the self-concept level) are also affected, or even guided, by the basic tendency level—the enduring core of the personality system. These basic tendencies, in turn, might not be randomly distributed across populations (e.g., university disciplines, Lievens et al. 2002; or geographical regions, Stuetzer et al. 2016a; Obschonka et al. 2013). Hence, not each student has the same predisposition towards these characteristic adaptations (and an entrepreneurial self-concept, Obschonka et al. 2016b), and the success of the educational program may depend on, or differ by, these predispositions. One could therefore ask: Does the (long-term) effect of entrepreneurship education on the adaptive part of the *EPS* depend on the nature of the basic tendencies?

Another illustrative example of applying the *EPS* model is gender research. We know that one crucial role in the persisting gender gap in entrepreneurship across the globe (females show a lower propensity to engage in entrepreneurship) is played by gender differences in risk-taking and self-efficacy beliefs (Kelley et al. 2011). In addition, cross-national research indicates that the entrepreneurial Big Five profile systematically differs between the sexes with men scoring higher in many cultures (Obschonka et al. 2014). In view of the present results, future research could test a pathway from gender (as the biological level), to the basic tendencies (e.g., entrepreneurial Big Five profile), to the characteristic adaptations (i.e., self-efficacy and risk-taking), and to entrepreneurial behavior. This research could also consider the proposed reciprocal effects between the adaptive part of the *EPS* and the entrepreneurial behavior.

Other examples of further research refer to (1) habitual entrepreneurship (e.g., Does repeat entrepreneurship change the *EPS* in a characteristic way—via an interplay with the basic tendencies level?) (see Roberts et al. 2003), (2) entrepreneurial development across the life span (e.g., How do characteristic entrepreneurial adaptations and the entrepreneurial self-concept develop from childhood on, via the interplay between the basic tendencies and developmental contexts?) (Obschonka and Silbereisen 2012), (3) research on stimulating proximal contexts and the wider macro-culture (e.g., How exactly does the social ecology affect

the adaptive part of the *EPS* and thus entrepreneurial outcomes?) (Hopp and Stephan 2012; McCrae et al. 2005), (4) research on biological aspects of entrepreneurship such as genetics and neuroscience (e.g., What are the pathways through which the biological system affects entrepreneurial outcomes?) (Nicolaou and Shane 2014), (5) research on entrepreneurial regions and ecosystems (e.g., Does the entrepreneurial Big Five profile lead to regional entrepreneurial activity via a mediating effect on entrepreneurial characteristic adaptations at the regional level?) (Obschonka et al. 2013), and (6) research on the role of personality coherence and underlying coherence tendencies in personality development over the life span (e.g., Are entrepreneurs more successful and satisfied with their work when they achieve a better intraindividual coherence with regard to the different *EPS* levels?) (Cervone and Shoda 1999; Sheldon and Kasser 1995).

Finally, future research could also use the *EPS* framework to study alternative forms of entrepreneurship such as intrapreneurship and social entrepreneurship. While the relationship and interactions between the different levels described in the *EPS* framework should be the same here, due to the general and universal nature of the underlying meta-framework from the personality psychology literature, the actual variables and their meanings within these levels might differ as a function of the target outcome. For example, social entrepreneurship might involve characteristic adaptations that specifically refer to these outcomes (e.g., attitudes, control beliefs, and skills that are useful particularly for intrapreneurship or social entrepreneurship). The same should apply for the self-concept level (e.g., self-identity with regard to intrapreneurship or social entrepreneurship) and the basic tendency level.

Our empirical analyses are not without limitations. We studied a set of characteristic adaptations that are usually highlighted in the entrepreneurship literature but future studies could use the EPS model to study other entrepreneurial characteristic adaptations as well. Whereas our study focused on the link between the basic tendency level and the characteristic adaptation level in the general population, the results also showed that some of the characteristic adaptations did not show the expected effect on entrepreneurial behavior (e.g., self-efficacy and control beliefs on self-employment entry). Future research should clarify whether cultural differences might play a role (e.g., whether self-efficacy is not so relevant for entrepreneurship in the Australian context). Usually, psychological research finds that self-efficacy is among the most important and predictive personality characteristics in entrepreneurship research. Another limitation of this study is its focus on self-employment, and not on more prototypical entrepreneurial behavior. However, once again, we see that as a minor concern given the study's focus on the link between basic tendencies and characteristic adaptations. Moreover, we should note again that the Big Five traits are not perfectly stable but are also subject to change over the life course (e.g., normative, age-correlated change). Research indicates, however, that these changes are relatively small. A recent overview of theories on personality change can be found in Specht et al. (2014). It is clear though that we need more entrepreneurship research studying the development and change of the entrepreneurial personality and its components. Finally, the entrepreneurial Big Five profile that is studied in the empirical literature should be seen as a rather broad measure of personality structure (e.g., it does not consider the individual shape of the Big Five profile but a general deviation of all traits from a reference profile). Future research could examine more fine-grained profiles, but it is likely that effects differ as a function of outcomes used. Entrepreneurship can be defined in very different ways, which is indicative of a broad definition of the entrepreneurial Big Five profile as applied in the literature.

To conclude, this paper seeks to illustrate the usefulness of a holistic, biopsychosocial system perspective on the entrepreneurial personality and its intraindividual dynamics. In both research and practice, it seems fruitful to keep in mind that the individual entrepreneurial personality, as a whole, is a dynamic system involving the person's basic traits—the basic tendencies that are relatively stable and hard to change, and those (more malleable) characteristic adaptations and self-concept features that directly motivate, guide, and regulate entrepreneurial behavior—within the boundaries of an enduring gravity effect of the basic tendencies though.

Appendix

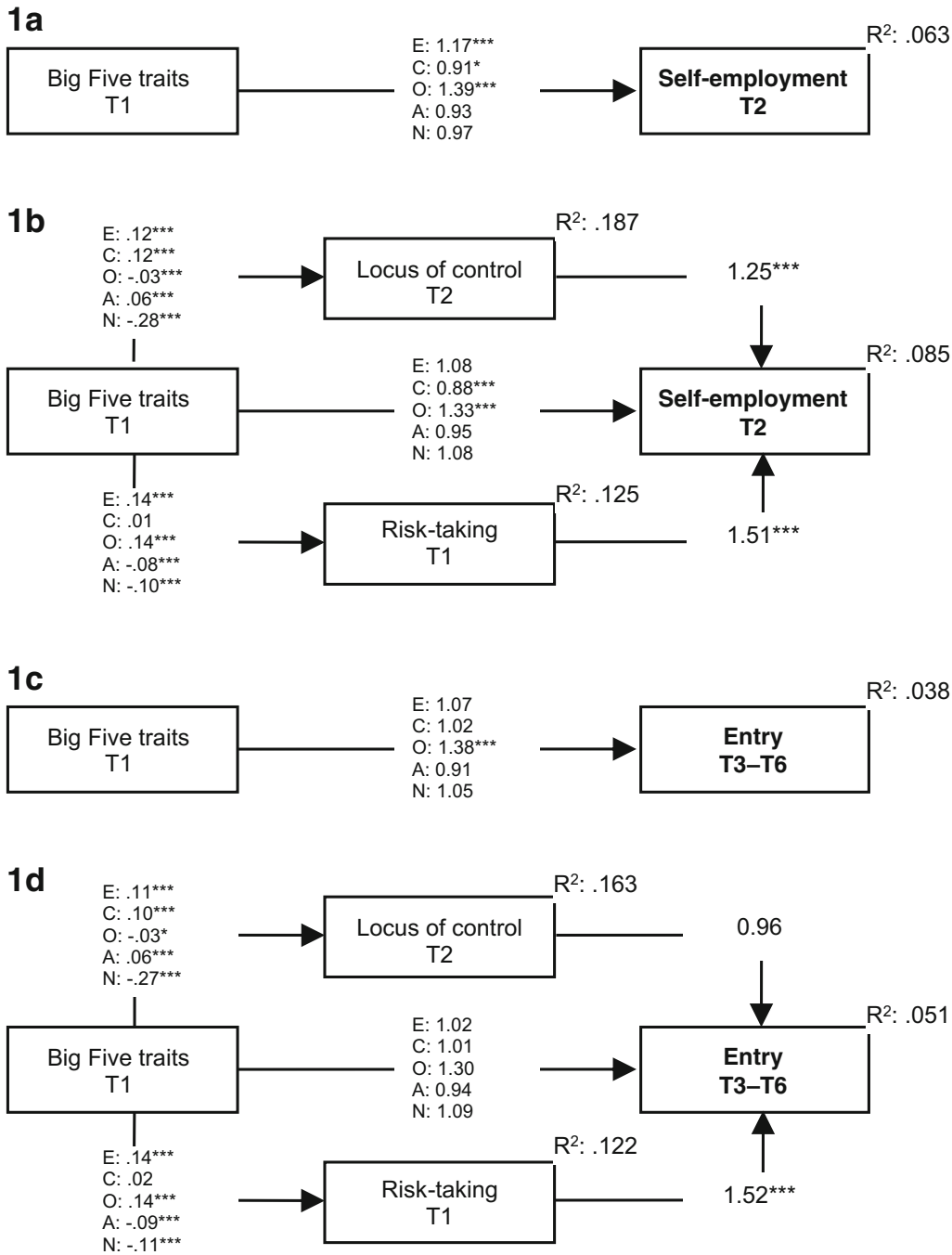

Fig. 3 Results for the single Big Five traits in the German GSOEP sample. *Note.* **1a** Direct effect model on *self-employment* status, **1b** mediation model *self-employment* status with locus of control and risk-taking as mediators, **1c** direct effect model on *entry* into self-employment, **1d** mediation model on *entry* into self-employment with locus of control and risk-taking as mediators. All effects are controlled for age, age^2, education, and education^2. Models **1b** and **1d** test the effect of a single Big Five trait as independent variable in a mediation setting while controlling for the effects of the other Big Five traits not under consideration. OLS regressions with *locus of control* and *risk-taking* as DV presenting unstandardized coefficients on the paths and adjusted R^2 in the upper corner. Logistic regressions with *self-employment* and *entry* as DV presenting odds ratios on the paths and McFadden's R^2. All personality variables are z-standardized. $^*p < .05$, $^{**}p < .01$, $^{***}p < .001$

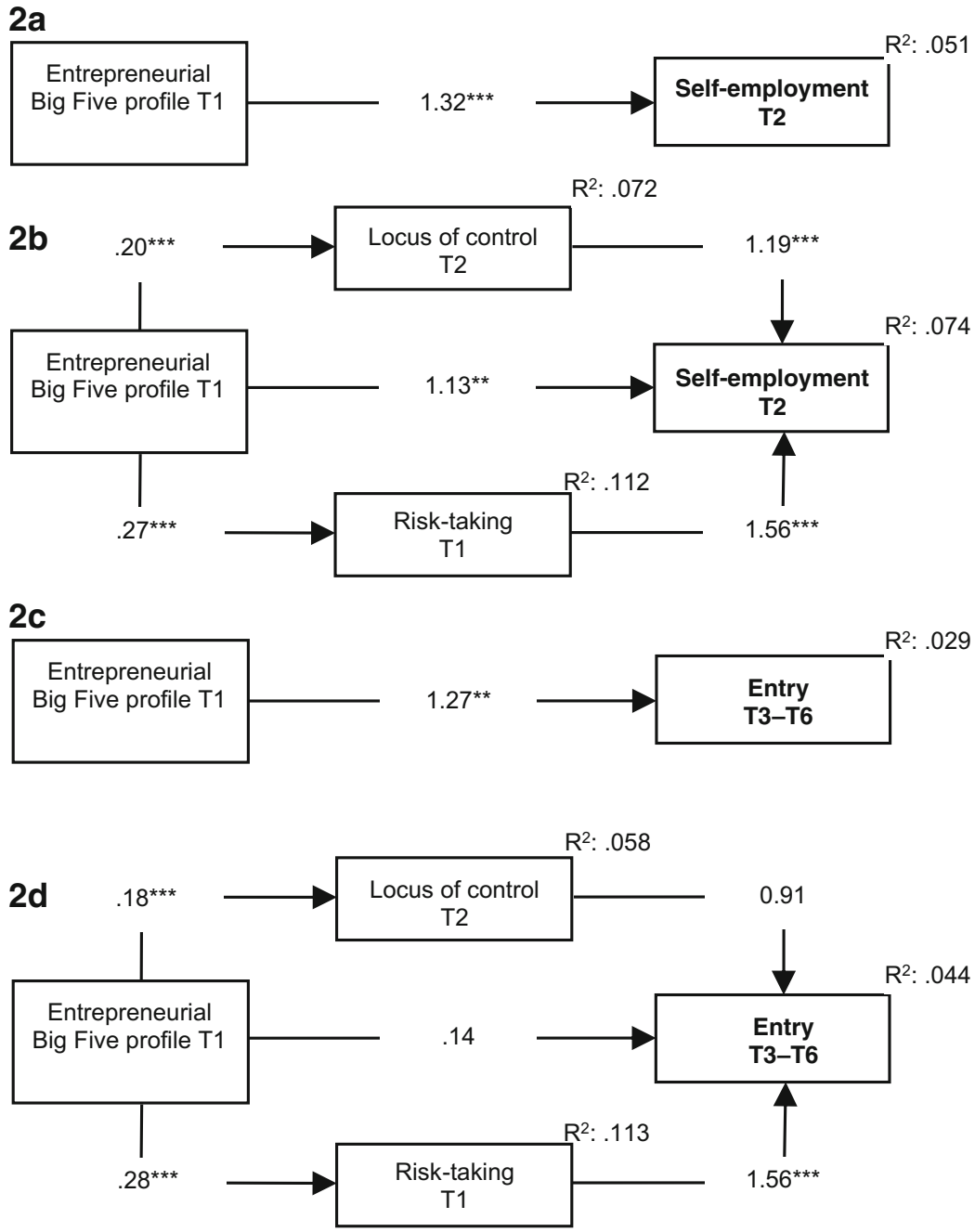

Fig. 4 Results for the entrepreneurial Big Five profile in the German GSOEP sample. *Note*. **2a** Direct effect model on *self-employment* status, **2b** mediation model on *self-employment* status with locus of control and risk-taking as mediators, **2c** direct effect model on *entry* into self-employment, **2d** mediation model on *entry* into self-employment with locus of control and risk-taking as mediators. All effects are controlled for age, age^2, education, and education^2. OLS regressions with *locus of control* and *risk-taking* as DV presenting unstandardized coefficients on the paths and adjusted R^2 in the upper corner. Logistic regressions with *self-employment* and *entry* as DV presenting odds ratios on the paths and McFadden's R^2. All personality variables are z-standardized. *$p < .05$, **$p < .01$, ***$p < .001$

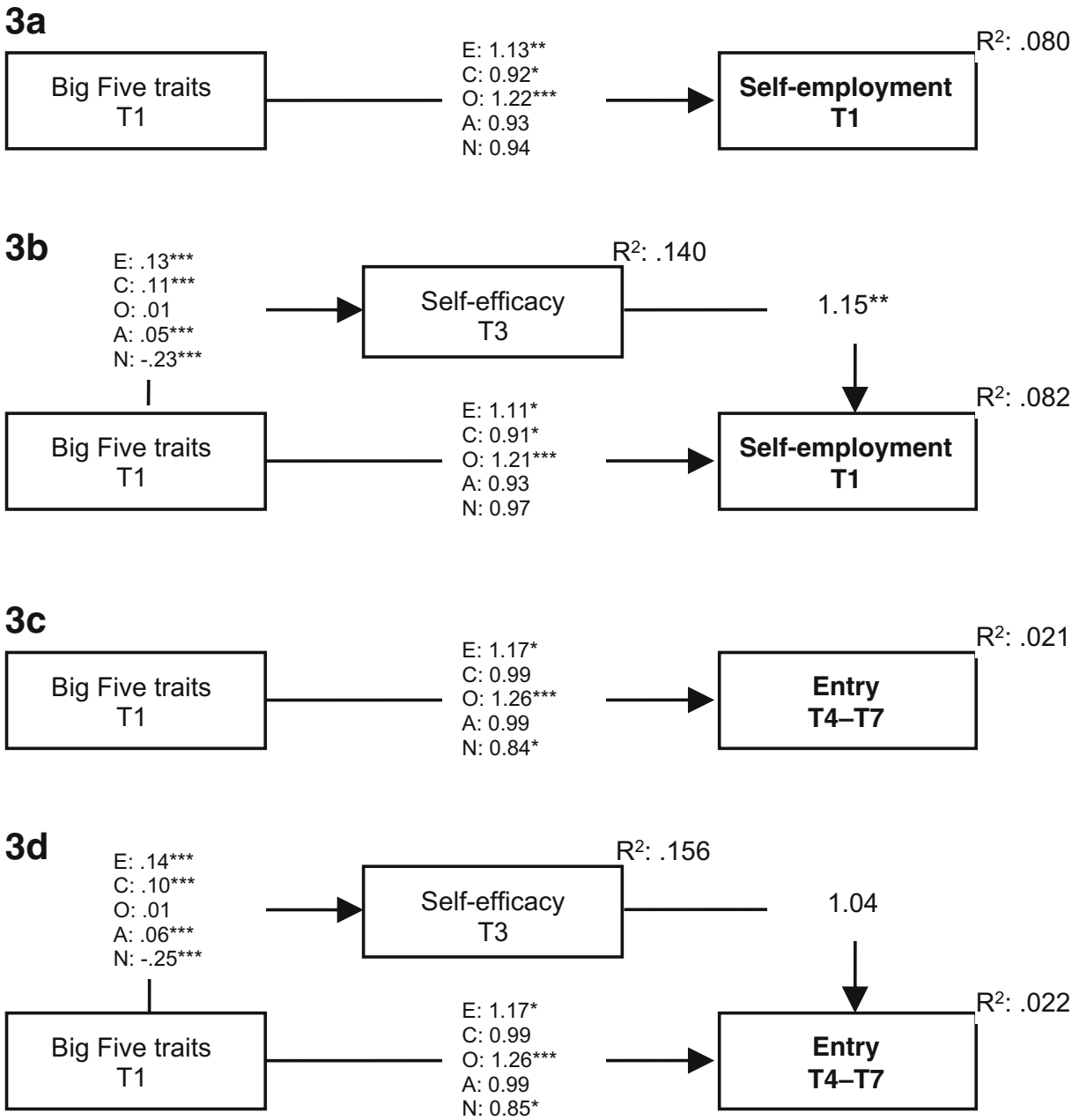

Fig. 5 Results for the single Big Five traits in the Australian Hilda sample. *Note*. **3a** Direct effect model on *self-employment* status, **3b** mediation model on *self-employment* status with self-efficacy as mediator, **3c** direct effect model on *entry* into self-employment, **3d** mediation model on *entry* into self-employment with self-efficacy as mediator. All effects are controlled for age, age^2, education, and education^2. Models **3b** and **3d** test the effect of a single Big Five trait as independent variable in a mediation setting while controlling for the effects of the other Big Five traits not under consideration. OLS regressions with *self-efficacy* as DV presenting unstandardized coefficients on the paths and adjusted R^2 in the upper corner. Logistic regressions with *self-employment* and *entry* as DV presenting odds ratios on the paths and McFadden's R^2. All personality variables are z-standardized. *$p < .05$, **$p < .01$, ***$p < .001$

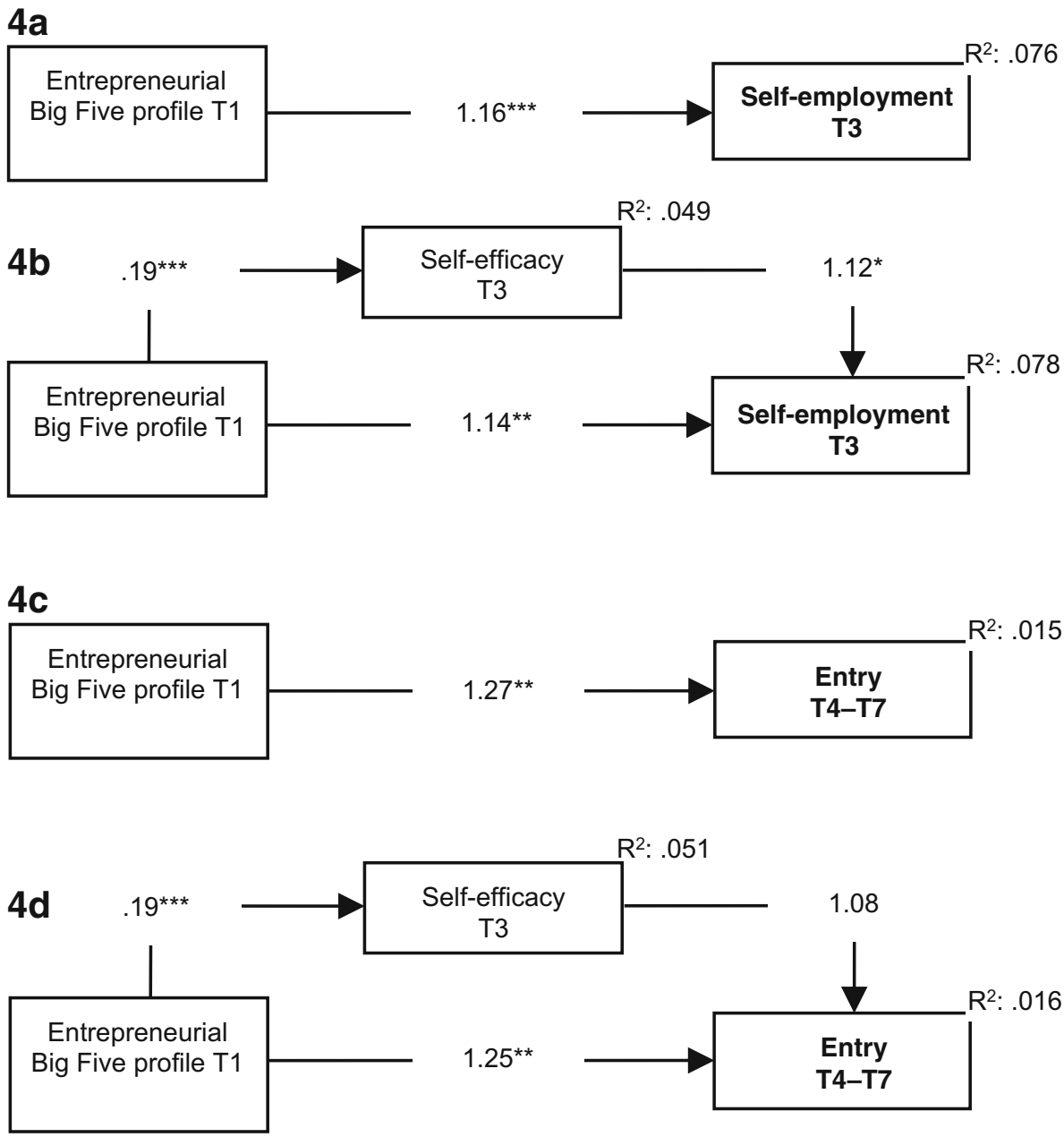

Fig. 6 Results for the entrepreneurial Big Five profile in the Australian HILDA sample. *Note*. **4a** Direct effect model on *self-employment* status, **4b** mediation model on *self-employment* status with self-efficacy as mediator, **4c** direct effect model on *entry* into self-employment, **4d** mediation model on *entry* into self-employment with *self-efficacy* as mediator. All effects are controlled for age, age^2, education, and education^2. OLS regressions with *self-efficacy* as DV presenting unstandardized coefficients on the paths and adjusted R^2 in the upper corner. Logistic regressions with *self-employment* and *entry* as DV presenting odds ratios on the paths and McFadden's R^2. All personality variables are z-standardized. *$p < .05$, **$p < .01$, ***$p < .001$

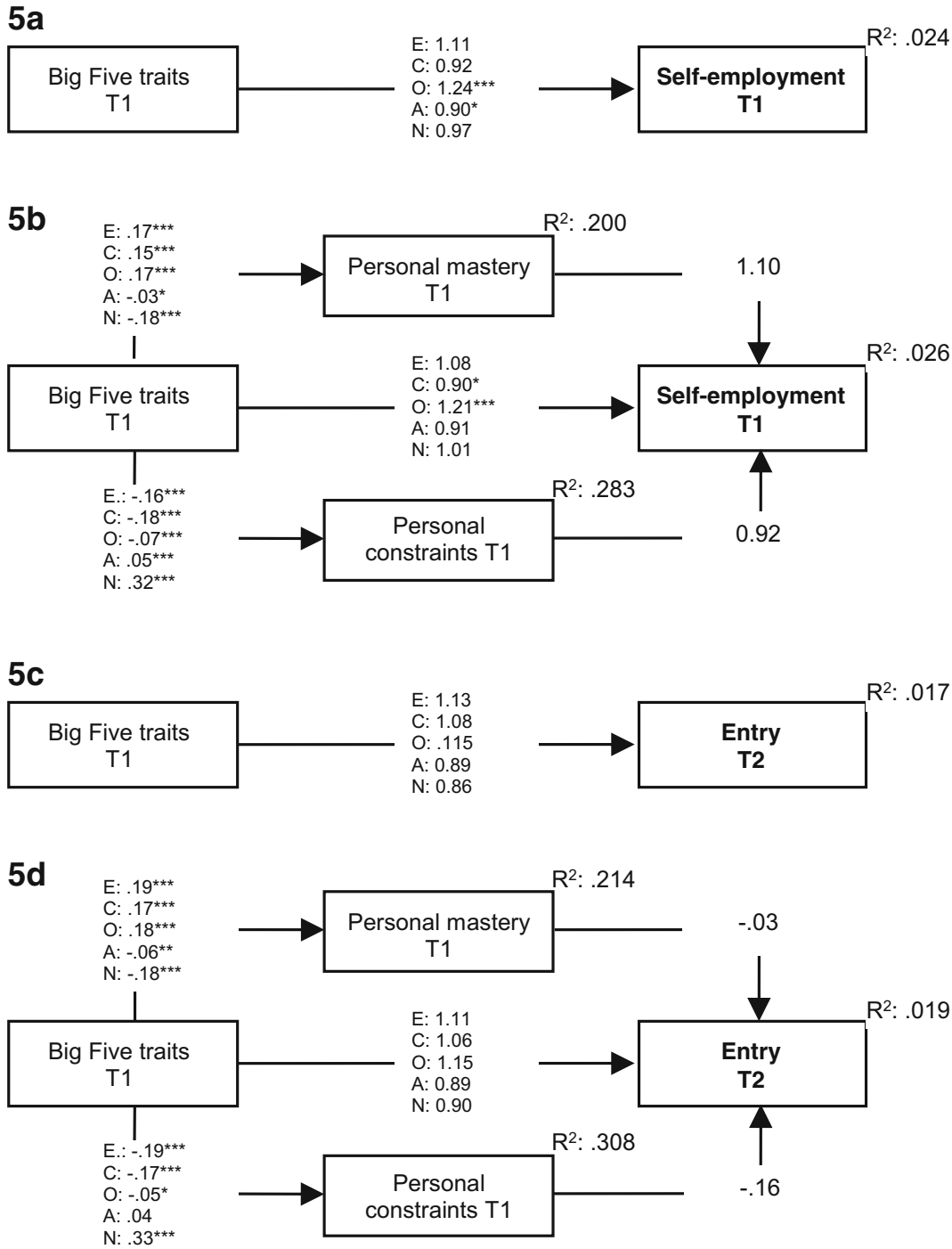

Fig. 7 Results for the single Big Five traits in the US MIDUS sample. *Note*. **5a** Direct effect model on *self-employment* status, **5b** mediation model *self-employment* status with personal mastery and personal constraints as mediators, **5c** direct effect model on *entry* into self-employment, **5d** mediation model on *entry* into self-employment with personal mastery and personal constraints as mediator. All effects are controlled for age, age^2, education, and education^2. Models **5b** and **5d** test the effect of a single Big Five trait as independent variable in a mediation setting while controlling for the effects of the other Big Five traits not under consideration. OLS regressions with *personal mastery* and *personal constraints* as DV presenting unstandardized coefficients on the paths and adjusted R^2 in the upper corner. Logistic regressions with *self-employment* and *entry* as DV presenting odds ratios on the paths and McFadden's R^2. All personality variables are z-standardized. *$p < .05$, **$p < .01$, ***$p < .001$

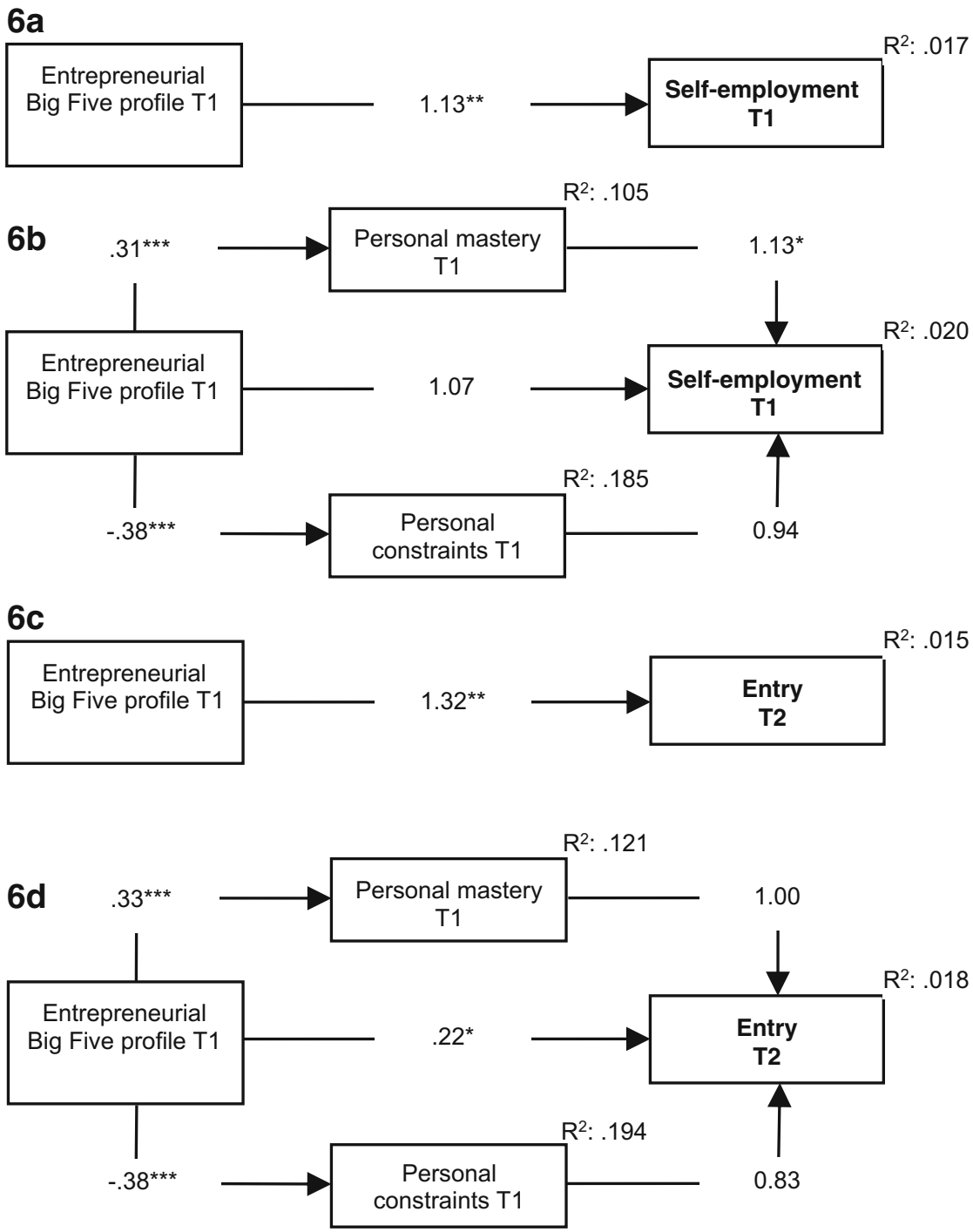

Fig. 8 Results for the entrepreneurial Big Five profile in the US MIDUS sample. *Note*. **6a** Direct effect model on *self-employment* status, **6b** mediation model on *self-employment* status with personal mastery and personal constraints as mediators, **6c** direct effect model on *entry* into self-employment, **6d** mediation model on *entry* into self-employment with personal mastery and personal constraints as mediator. All effects are controlled for age, age^2, education, and education^2. OLS regressions with *personal mastery* and *personal constraints* as DV presenting unstandardized coefficients on the paths and adjusted R^2 in the upper corner. Logistic regressions with *self-employment* and *entry* as DV presenting odds ratios on the paths and McFadden's R^2. All personality variables are z-standardized. *$p < .05$, **$p < .01$, ***$p < .001$

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