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A personality perspective on business angel syndication☆ ☆

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ABSTRACT

The decision to syndicate investments in entrepreneurial finance has been explained through financial, networking, and resource-based perspectives. We posit that a personality perspective exists next to these three perspectives and hypothesize that the personality of business angels influences syndication behavior. Using data from 3,234 syndication decisions of 1,348 business angels, we find evidence for some of our predictions. By measuring personality through a comprehensive language analysis based on digital footprints in Twitter statements of business angels, we show that extraversion makes syndication more likely, whereas conscientiousness reduces the likelihood of syndication. Several sensitivity analyses underline the robustness of our main results. Further exploratory analyses assess the relationship between personality and syndicate composition as well as that between personality and venture success. Our study contributes to the entrepreneurial finance literature by adding and validating a new perspective to explain syndication behavior. In addition, our study contributes to research on the personality of business angels.

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1. Introduction

Business angels are an important source of funding for innovative start-ups and an important driver for new venture development and innovation (Croce et al., 2018; Dutta and Folta, 2016; Kim and Wagman, 2016; Lerner, 1998). They not only provide badly needed financial capital in the early stages of new venture development but also help start-ups with their management know-how and network access (Dutta and Folta, 2016; Kerr et al., 2014; Prowse, 1998). Business angels can invest alone or through an investment syndicate together with other investors. While syndication is a topic that has received considerable attention in the entrepreneurial finance literature, little is known about business angels' syndication decisions. Specifically, the prior literature's focus is almost exclusively on venture capital (VC) firms, and the decision to syndicate has been explained from financial, networking, and resource-based perspectives (e.g., Bygrave, 1987; Dimov and Milanov, 2010; Lockett and Wright, 2001; Manigart et al., 2006; Sorenson and Stuart, 2001; Ter Wal et al., 2016).

We argue that in addition to these three perspectives, a personality perspective on business angel syndication exists. Business angels invest their own money and act as individual investors. Their personality plays an important role with regard to their preferences and investment styles. Based on psychology literature on inter-individual differences in personality traits (Digman, 1990; John et al., 2008) and their important effects on decision-making and investment behavior (e.g., Corter and Chen, 2006; Durand et al., 2008; Gambetti and Giusberti, 2012), we hypothesize that the business angel's personality influences the choice to invest alone or as part of a syndicate. Using the Big Five personality traits (extraversion, conscientiousness, openness, agreeableness, and neuroticism) as a comprehensive personality framework, we hypothesize that business angels high in extraversion, agreeableness, or neuroticism are more likely to engage in syndication. In contrast, we assume that business angels high in openness and conscientiousness are less likely to engage in syndication.

Using data from 3,234 syndication decisions of 1,348 business angels, we find support for some of our predictions. Measuring personality via a novel but validated method of language

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analysis that analyses business angels' posts on Twitter to infer their personality structure, we show that extraversion makes syndication more likely, whereas conscientiousness reduces the likelihood of syndication. Openness, agreeableness, and neuroticism do not show statistically significant effects. Multiple sensitivity analyses underline the robustness of our results. Furthermore, we explore the effects of business angel personality on other important outcomes, such as syndicate characteristics and investment success. These exploratory analyses show that a business angel's personality has an influence on the composition of the syndicate but seems to be unrelated to venture success, opening up many avenues for future research.

Our results contribute to the entrepreneurial finance literature in three ways. First, we contribute to the (business angel) syndication literature (e.g., Dimov and Milanov, 2010; Duxbury et al., 1996; Lerner, 1998; Sorenson and Stuart, 2001; Wright and Lockett, 2003) by showing that a business angel's personality plays an important role in the decision to form a syndicate or not. To date, the personality of investors such as business angels has not been considered a factor driving the syndication decision. Our study introduces this personality perspective to the syndication literature. Second, our study contributes to the literature on business angels (e.g., Croce et al., 2018; Dutta and Folta, 2016; Kim and Wagman, 2016). We show that business angels are a heterogeneous group and that personality plays a crucial role in their behavior as investors. So far, research has focused mainly on socio-demographic and human capital characteristics describing the heterogeneity of business angels as a group (e.g., Becker-Blease and Sohl, 2011). Third, our study makes a methodological contribution by showing that the business angel personality measured through Tweets correlates with business angel investment behavior. Such methods have been shown to deliver remarkably accurate information about actual personality features (Boyd and Pennebaker, 2017; Kosinski et al., 2013). In particular, using Twitter data allows access to groups of individuals who have been very hard to reach and include in empirical studies (Lee et al., 2017; Obschonka et al., 2017; Obschonka and Fisch, 2018). Business angels fall into this category. This way, our study opens up a new research agenda for research using data from social media such as Twitter to describe entrepreneurial finance investors and predict their investment behavior.

The remainder of the study is organized as follows. Section 2 summarizes the existing research on syndication in new venture financing and describes the benefits and costs of syndication. Section 3 introduces our personality perspective and develops hypotheses about the relationship between business angel personality and syndication. Subsequently, we describe our dataset and variables in Section 4. In addition, we introduce our Twitter-based approach to measure business angel personality. Section 5 shows the results of our main analysis, Section 6 reports multiple sensitivity analyses, and Section 7 presents further exploratory analyses using other outcome variables. Section 8 concludes.

2. Literature review

2.1. Benefits of syndication for business angels

Why do business angels syndicate their investments? Based on insights from VC firms, prior research offers three perspectives on business angel syndication (e.g., De Vries and Block, 2011; Lerner, 1998; Lockett and Wright, 2001; Manigart et al., 2006).

First, the *financial perspective* (Dimov and Milanov, 2010; Manigart et al., 2006) maintains that syndication allows investors to finance a larger number of ventures. This way, the investor is able to diversify his or her portfolio, reducing the investor's investment risk. Syndication is a means to achieve optimal portfolio diversification (e.g., van Osnabrugge, 1998). Without syndication, single investments will account for a relatively large investment share, hence leading to a higher risk exposure. Additionally, investors gain more flexibility with regard to liquidity by spreading their money over more investments. This argument is particularly true for business angels who typically have lower amounts of money to invest than corporate investors (e.g., Croce et al., 2018; van Osnabrugge, 2000). Another financial perspective argument for syndication relates to the increased exit opportunities available through syndication. Business angels typically only finance the first rounds of investment in the venture financing cycle (e.g., Croce et al., 2018). Through syndication with VC firms or strategic investors, business angels increase their chances of a successful exit. If the venture turns out to be a success, business angels can sell their equity stake to their co-investors.

Second, the *networking perspective* postulates that syndication is a result of investor networks and is an important prerequisite to securing future deal flow (Bygrave, 1987; Dimov and Milanov, 2010; Sorenson and Stuart, 2001). In the entrepreneurial finance community, it is expected that invitations to join a syndicate will be reciprocated. Hence, business angels secure a sufficient deal flow, which allows them to spread their investment risk and generate enough attractive investment opportunities.

Third, the *resource-based* or *value-added perspective* argues that syndication is a way for different investors to share (complementary) knowledge and assets and thereby create value for the start-ups and the investment syndicate (Cumming et al., 2005; Dimov and Milanov, 2010; Lockett and Wright, 2001; Ter Wal et al., 2016). For example, investment partners can provide additional knowledge on an investment target during due diligence, thereby improving the overall quality of the final investment decision and preventing adverse selection (Lerner, 1998). Previous research indicates that VCs conduct significantly more due diligence than business angels as they typically have more experience and resources to carry out a thorough due diligence (van Osnabrugge, 2000). Syndication is a way to overcome this disadvantage for business angels.

2.2. Disadvantages and costs of syndication for business angels

The financial, networking, and resource-based perspectives capture the potential benefits and reasons for syndication. However, syndication also has disadvantages. It can lead to costs that may outweigh the benefits and make syndication unattractive. Many of these costs are personal, and their level as well as the importance attached to them varies depending on the personality of the business angel. Syndication can lead to severe agency conflicts within the investment syndicate and thereby create transaction costs. Freeriding behavior can occur and can lead to costs to monitor or sanction opportunistic behavior (De Clerq and Dimov, 2008). Such freeriding, coordination, and monitoring costs increase with syndication size (Manigart et al., 2006). However, even with goal alignment between the syndication partners and without agency conflicts, there is often a high need for coordination between the syndication partners (Fried and Hisrich, 1995). Wright and Lockett (2003), for example, argue that even with familiar syndicate partners, there is a high likelihood of complications, difficult negotiations, and delays in decision-making.

In the next section, we shall argue that the personality of the business angel influences their investment decisions (i.e., investing via syndication) because personality determines a general, coherent pattern in a person's decision-making across different contexts and situations, including investment decisions. We shall argue that in the specific case of syndication personality influences (1) the level of benefits and costs associated with syndication and (2) the importance attached to these benefits and costs by the respective

individual business angel. While the first aspect refers to the objective level of costs and benefits, the second aspect refers to the subjective weight attached to these costs and benefits.

3. Theory and hypotheses

3.1. A personality perspective on syndication

Personality can be defined as the sum and characteristic structure of a person's personality characteristics (e.g., traits), reflecting his or her characteristic patterns of thinking, feeling, and behaving across different situations (John et al., 2008; McCrae and Costa, 2008). The relatively stable personality traits can be understood as an enduring core of a person's personality, guiding and directing his or her life in certain directions throughout the life course. Research has indeed established this "power of personality", in that traits are remarkably accurate predictors of all sorts of important life outcomes (e.g., happiness, physical and psychological health, and quality of relationships with peers, family, and romantic others, as well as occupational choice, satisfaction, and performance), even when controlling for socioeconomic status and cognitive ability (Ozer and Benet-Martínez, 2005; Roberts et al., 2007). Researchers aiming to explain human behavior and underlying decision-making processes have thus developed a strong interest in the impact that personality traits have.

There is also considerable interest in personality traits in traditionally non-psychological scientific disciplines such as finance (Barber and Odean, 2001; Corter and Chen, 2006; Mayfield et al., 2008). For example, in investor psychology, one tries to understand the effect of personality traits on different forms of investment behavior (e.g., Mayfield et al., 2008; Merkle, 2017). This research demonstrates that investment decisions often cannot be fully explained by means of economic models based on pure rationality (Kahneman and Riepe, 1998). Interindividual differences in preferences, attitudes, expectations, and perceptions also play a role, and personality traits shape these psychological processes in a characteristic way, thereby affecting and guiding investment decisions (John et al., 2008). Research found, for example, that expected gains and losses are influenced by personality traits (Boyce et al., 2016). Other research indicates that personality traits shape the perceptions of the potential benefits and costs associated with investments (Mitteness et al., 2012). While such research on the influence of personality on investment decisions has gained momentum in the finance literature in recent years, personality itself has not been accounted for in regard to syndication decisions (e.g., business angel syndication).

3.2. Hypotheses: business angel personality (Big Five) and syndication

Many personality researchers agree that the best model to capture personality traits is the so-called five-factor model, also known as the Big Five traits (McCrae and Costa, 2008). The Big Five traits are openness to new experience, extraversion, conscientiousness, agreeableness, and neuroticism. The five-factor model is the predominating and most-researched personality model in psychological science (Barrick and Mount, 1991; John et al., 2008; Obschonka et al., 2013). In the following, we formulate hypotheses on how the Big Five relate to business angel syndication. The hypotheses are based on three core assumptions. First, personality has an influence on the respective levels of costs and benefits of syndication (see Section 2). Second, personality traits shape the individual perceptions and expectations as well as the importance attached to these benefits and costs of syndication. Third, as people are motivated to have a certain coherence in their personality and in their decision-making and behavioral patterns across different contexts and situations (Cervone and Shoda, 1999), business angels make investment decisions (e.g., syndication vs. investing alone) that fit their personality trait structure to achieve and maintain such personality coherence as a general intrapsychological motive.

3.2.1. Openness to experience

Openness to experience is a Big Five trait that summarizes an individual's tendency to favor creativity and new situations. People high in this trait are open-minded and often interested in arts and new technologies. Additionally, they generally favor variety and diversity and possess intellectual curiosity (LePine and Van Dyne, 2001). Hence, people high in openness often score high in creativity and divergent thinking tests (Batey and Furnham, 2006), indicating highly developed cognitive abilities and skills. Finally, they are more open to stereotype-disconfirming information than other individuals, which facilitates the correction of individual prejudices and stereotypes (Flynn, 2005). People scoring low in this trait, in turn, favor conventions and traditions. They are less attracted by diversity and variety.

Syndication involves cooperation that represents more diversity (investor team compared to investing alone) and incurs a higher need for coordination between the syndication partners than investing alone. Cooperation can lead to multiple complications, such as difficult negotiations and/or delays in decision-making. We argue that the coordination within the syndicate becomes easier and less costly with syndicate partners who are open to divergent opinions, attitudes, and behaviors. In addition, business angels who are high in openness might not perceive these coordination costs as important or painful because they also see the necessity to coordinate with syndicate partners as an opportunity to gain new experiences by learning from others. In other words, they might be more open to and attracted by diversity in an investor team. They might also have better cognitive skills to cope with and utilize this diversity. Therefore, we expect business angels who are high in openness to engage in syndication more often and hypothesize the following:

Hypothesis 1. *Business angels with high levels of openness are more likely to syndicate their investments than are business angels with low levels of openness.*

3.2.2. Extraversion

Extraversion describes an individual's tendency to favor an outgoing, talkative, and energetic style in one's social interactions (e.g., Furnham, 1981). The most important implication of high extraversion is usually seen in an extravert's tendency to prefer and enjoy (active) engagement in social groups (compared to doing things alone). Research shows that extraverts are generally enthusiastic and active when working in groups because this social setting rewards them via neurobiological mechanisms (Ashton et al., 2002). In other words, individuals high in this trait seek active engagement in groups as they obtain socio-emotional benefit out of it. This interpersonal engagement was validated in a wide range of contexts. Research showed, for example, that university students who are high in extraversion show a stronger preference to work in groups (vs. alone) (Chamorro-Premuzic et al., 2005). Workers who are high in extraversion show more self-efficacy for participating in self-managed work groups than workers low in this trait (Thoms et al., 1996).

Syndication requires business angels to cooperate with other investors, which is generally associated with some costs, such as a need for coordination between the syndication partners. We argue that this disadvantage and cost of syndication will be perceived as less painful by business angels high in extraversion. Given that the central characteristic of extraversion is the preference for actively engaging in social interactions and groups (Depue and Collins, 1999), compared to doing things alone, it seems plausible

to assume that extraverted business angels will show a stronger tendency for syndication than introverted business angels. Similar to business angels high in openness, they might even attach a positive value to the need for coordination. Yet, it is the social aspect of coordination and not the learning aspect that matters for them. We hypothesize:

Hypothesis 2. *Business angels with high levels of extraversion are more likely to syndicate their investments than are business angels with low levels of extraversion.*

3.2.3. Conscientiousness

Conscientiousness is a Big Five trait that mirrors efficient self-regulation and the capacity to organize and manage one's own projects alone. This trait has thus been established as the central trait in research on individual academic and work performance (Barrick and Mount, 1991; Higgins et al., 2007). People scoring high in conscientiousness show high levels of self-discipline and achievement-orientation. Thus, these people prefer to work in settings that require high levels of independence and self-regulation and self-discipline such as entrepreneurship (Brandstätter, 2011). People high in this trait also show less risky and more healthy behaviors, which explain why they show better health and longevity than people low in this trait (Bogg and Roberts, 2004). People who score low in conscientiousness are more laid back, less self-organized, more chaotic, and less driven by individual success. They often exhibit procrastination (Watson, 2001) and are perceived as relatively low in professionalism by their peers (Finn et al., 2009). As "they lack the tenacity to persevere in most situations", they received intensified attention in intervention research aiming at promoting work-related performance and the effective training of work skills (Cheramie and Simmering, 2010, p. 45).

Since people scoring high in this trait have a tendency to get things done alone in a structured and efficient manner, we expect business angels scoring high in this trait to prefer investing alone and not in syndication. We argue that the costs incurred by syndication are higher for business angels high in conscientiousness. Such costs comprise agency and coordination costs. To avoid opportunistic and freeriding behavior within the syndicate, monitoring efforts are necessary. Moreover, to establish goal alignment between the syndicate partners, extensive coordination between the syndicate partners is needed. Business angels high in conscientiousness will invest more in monitoring and coordination efforts and will perceive such efforts as more painful. After all, they strive for a well-planned, efficient, and highly-structured investment process which is more difficult to achieve when investing with others. In turn, business angels with low scores in conscientiousness might prefer to invest in groups as some sort of compensation for their low self-regulation and self-discipline. They benefit strongly from syndication as they are unlikely to carry out a careful due diligence themselves. Finally, business angels high in conscientiousness might show a stronger self-oriented perfectionism tendency than other business angels (Hill et al., 1997), so they could prefer to invest alone because they are more in control of this particular project and their own participation and achievements in this project. We thus hypothesize the following:

Hypothesis 3. *Business angels with high levels of conscientiousness are less likely to syndicate their investments than are business angels with low levels of conscientiousness.*

3.2.4. Agreeableness

Agreeableness is the Big Five trait that summarizes an individual's tendency towards harmony and altruism, for example, in social interactions. People scoring high in this trait show more trust, compliance, and modesty. People who are not agreeable, in turn, focus on competition and show rather selfish behavior with a tendency to manipulate others (Jakobwitz and Egan, 2006). High scores in agreeableness are associated with a high need for affiliation because these people show cooperative values and a preference for harmonious interpersonal relationships (Zhao and Seibert, 2006). People who are low in agreeableness are typically driven by higher self-interest and are also more likely to manipulate others for their own advantage. They are able to drive hard bargains due to their non-conformist attitude.

Syndication involves the need for cooperative decision-making and negotiations. This leads to coordination and negotiation efforts. We argue that the costs associated with these efforts depend on the level of agreeableness of the syndication partners. Business angels high in agreeableness strive for harmony in the syndicate and are likely to trust their syndication partners. The likelihood of severe conflicts decreases. This is underlined by the fact that individuals with high levels of agreeableness favor conformist group perspectives (e.g., they tend to show better capabilities of reaching common decisions and prefer to engage in cooperative efforts more often than do individuals with low levels of agreeableness). Moreover, business angels who are high in this trait are likely to show more trust in others (e.g., other investors in a particular project) (Evans and Revelle, 2008), which might make it easier for them to invest via syndication. Therefore, we hypothesize the following:

Hypothesis 4. *Business angels with high levels of agreeableness are more likely to syndicate their investments than are business angels with low levels of agreeableness.*

3.2.5. Neuroticism

Finally, neuroticism is the Big Five trait that describes subclinical neurotic tendencies in the sense that people scoring high in this trait are more prone to negative feelings such as fear, guilt, anger, or worry. They tend to cope with stress and uncertain situations less effectively, are moodier, and have a rather negative perspective on the world as such (Barlow et al., 2014). Therefore, people high in neuroticism avoid risks, whereas people low in neuroticism are emotionally stable, self-confident, and remain calm in difficult situations. Research consistently shows, for example, that individuals higher in neuroticism are less likely to engage in activities that involve risks and uncertainty as well as higher levels of stressors (Brandstätter, 2011). Moreover, high levels of this trait are an important risk factor for clinical disorders such as panic disorder, depression, or phobias, so high neuroticism levels can impose high costs for society (Cuijpers et al., 2010).

Business angels may often engage in syndication to diminish their investment risks via cooperation (Manigart et al., 2006; Dimov and Milanov, 2010). Hence, business angels high in neuroticism could show low levels of self-confidence and risk-taking as well as an inability to cope with high uncertainty and risks. Therefore, they could have a tendency to engage in cooperative investment behavior such as syndication, which minimizes risks and helps to cope with such risks. It could also help avoid a feeling of being on one's own when facing risk and uncertainty. Research has shown, for example, that people who are high in neuroticism put a special emphasis on loss aversion in risky decision-making processes (e.g., Lauriola and Levin, 2001). We thus hypothesize the following:

Hypothesis 5. *Business angels with high levels of neuroticism are more likely to syndicate their investments than are business angels with low levels of neuroticism.*

4. Data and method

4.1. Data sources and data set

We draw on Crunchbase (www.crunchbase.com) to identify our sample of business angels. Crunchbase is a public database that provides a comprehensive overview on VC funding and the entities involved, such as business angels, large VC funds, and corporate VC funds. Because of its extensive and recent coverage, Crunchbase is increasingly used to assess questions on new venture financing (e.g., Ter Wal et al., 2016). Importantly, Crunchbase also contains information on investor's private social media channels (e.g., Twitter, Facebook, LinkedIn). We extracted all business angel data available in Crunchbase in October 2016 and identified a sample of 2,114 business angels that used Twitter. In addition to their name and Twitter account, we obtained data on their investments from Crunchbase, such as data on the venture and the financing round.

We use novel data to assess our hypotheses: To gain insights on business angels' psychological traits, we analyze each business angel's Twitter profile via a computerized language assessment using the Receptiviti API (www.receptiviti.ai). Receptiviti is a commercial variant of Linguistic Inquiry and Word Count (LIWC), which is the established standard software to assess language for psychological purposes (e.g., Pennebaker et al., 2015; Tausczik and Pennebaker, 2010). While language and text analysis have a rich history in the field of psychology, it has seen little use in the field of entrepreneurship. Based on an individual's Twitter profile, Receptiviti provides all measures generated by the academic LIWC application as well as several composite psychological measures, such as the Big Five personality traits (Pennebaker et al., 2015). Receptiviti has been used by Obschonka et al. (2017) and Obschonka and Fisch (2018) to contrast the psychological profiles of entrepreneurs, managers, and politicians. These studies also provide further information on the validity and measurements of Receptiviti.

We collect further personal data on the business angels (e.g., gender, age, education). Unfortunately, this information is available from Crunchbase in only a very rudimentary way (e.g., only 25% of the business angels had their year of birth registered in Crunchbase). Therefore, we performed an extensive web search and manually drew on newspaper articles, LinkedIn profiles, CVs on corporate websites, and other online resources to obtain this information if possible. To account for the national culture of the business angel, we used Hofstede's cultural dimensions framework (Hofstede, 1980) and retrieved data on national cultural dimensions from Geert Hofstede's website (www.geerthofstede.nl).

Our initial dataset was reduced for multiple reasons. First, and in line with previous research, we focused on first-round investments only because a business angel enters an existing syndicate if it is not a first-round funding (e.g., Cumming, 2006; De Clerq and Dimov, 2008; Gompers, 1995; Sahlman, 1990). Thus, the decision to syndicate or not cannot be decided upon by the business angel anymore, or at least not to the same extent as in first-round investments. Second, not everything that is broadcast on Twitter can be analyzed with language analysis software. Hence, Receptiviti uses a cleaning algorithm to exclude phrases that do not reflect an individual's personality, such as links, hashtags, and Retweets (i.e., simply repeating a message of another account). Receptiviti also requires a minimum number of words per person to deliver meaningful results, leading to the exclusion of accounts with a very low number of Tweets. Finally, we had to drop several observations because of missing values. Our final sample is still extensive and consists of 1,348 business angels that participated in 3,234 first-round investments.

4.2. Variables used in our main analysis

In addition to our dependent variable (syndication) and our independent variables (Big Five personality traits), we use several control variables that can be grouped into control variables at the level of the venture, business angel, and Twitter. All variables are displayed in Table 1, with brief descriptions. Table 1 also includes variables that were included in sensitivity analyses (Section 6) and further exploratory analyses using other outcome variables (Section 7).

4.2.1. Dependent variable (syndication)

Consistent with previous research, we captured *syndication* with a dummy variable equal to one if the investment was syndicated, and 0 if not (e.g., Cumming and Dai, 2010; De Vries and Block, 2011; Gu and Lu, 2014). This variable is constructed from Crunchbase's data on venture financing.

4.2.2. Independent variables (Big Five)

We used the Big Five personality traits (five-factor model, FFM) to measure business angels' psychological profiles and test our hypotheses. The data were obtained from Reciptiviti. While the algorithms of many Receptiviti measures are proprietary, they have primarily been established using widely used and well-validated psychometric techniques and principles, including various multimethod approaches that combine standard machine learning procedures with self-report, behavioral, and outcome data as well as domain expertise. Due to the varying constructions of the dimensions, they are scaled differently, but mostly range between -50 (very low score) and +50 (very high score) (Obschonka et al., 2017).

4.2.3. Control variables (venture level)

Multiple characteristics of the financed venture could influence the likelihood of syndication and are therefore controlled for. Data on this set of variables are obtained or constructed from Crunchbase. First, we control for the *amount raised (log.)*, indicating the amount of money (in USD) that the venture raised in the respective funding round in which the business angel was involved. Because of its skewness, we include the variable in log form. We control for this variable because sharing financial risk is one of the main drivers of syndication. Thus, the greater the amount invested, the higher the likelihood of syndication (e.g., Cumming et al., 2005; De Clerq and Dimov, 2004, 2008). Additionally, Ter Wal et al. (2016) used this variable to control for differing initial startup conditions, such as the founder's social capital and perceived quality of the idea.

The size of the venture correlates with the investment risk (Perez-Quiros and Timmermann, 2000). We control for the *venture's number of employees* as a proxy for *venture size*. This variable is obtained from Crunchbase in ordinal form. The smallest category (=1) refers to ventures with 1 to 10 employees, while the largest category refers to ventures with more than 1,000 employees (=7).

Following a similar reasoning, we control for the *venture's age (log.)* (e.g., Cumming et al., 2010, De Vries and Block, 2011). Older ventures often have a more established business and have proven themselves over a longer time frame without failure, thus reducing investors' uncertainty and making syndication less likely (De Clerq and Dimov, 2008).

Another factor that is crucial for investment decisions are the characteristics of the venture's founding team (e.g., Cumming et al., 2016; Mason and Stark, 2004). For example, a venture with a lone founder might signal a higher investment risk than a venture with

Table 1
Variables and their descriptions.
This table summarizes all variables, their descriptions, and the data source for each variable.

Variable name	Description	Data source
Dependent variable		
Syndication	Dummy variable that captures whether the investment was syndicated (=1) or not (=0).	Crunchbase
Independent variables: Big Five		
Openness	Degree to which a person is open to new ideas and new experiences.	Receptiviti (Twitter)
Extraversion	Degree to which a person feels energized and uplifted when interacting with others.	Receptiviti (Twitter)
Conscientiousness	Degree to which a person is reliable.	Receptiviti (Twitter)
Agreeableness	Degree to which a person is inclined to please others.	Receptiviti (Twitter)
Neuroticism	Degree to which a person expresses strong negative emotions.	Receptiviti (Twitter)
Control variables: Venture level		
Amount raised (log.)	The amount that was raised in the venture's funding (in USD and in logged form).	Crunchbase
Venture: Age (log.)	Age (in years) of the venture.	Crunchbase
Venture: No. of emp.	Number of employees of the venture (in seven size classes, from 1–10 to 1000+).	Crunchbase
Venture: No. of founders	Number of founders of the venture.	Crunchbase
Venture: Location US	Dummy variable that captures whether the venture is located in the US (=1) or not (=0).	Crunchbase
Venture: Location EU	Dummy variable that captures whether the venture is located in the US (=1) or not (=0).	Crunchbase
Round: Seed-stage	Dummy variable that captures whether the venture was in a seed-stage (=1) or not (=0).	Crunchbase
Year dummies	Dummy for the year in which the venture received its first funding (8 dummies).	Crunchbase
Industry dummies	Dummy for the industry in which the venture is mainly active (21 dummies).	Crunchbase
Control variables: Country level		
Hofstede: Power distance	Degree to which the less powerful members of a society accept and expect that power is distributed unequally.	www.geerthofstede.nl
Hofstede: Individualism	Individuals are expected to take care of only themselves and their immediate families.	www.geerthofstede.nl
Hofstede: Masculinity	Preference in society for achievement, heroism, assertiveness, and material rewards for success.	www.geerthofstede.nl
Hofstede: Uncertainty avoidance	Degree to which the members of a society feel uncomfortable with uncertainty and ambiguity.	www.geerthofstede.nl
Control variables: Investor level		
Previous investments (log.)	The number of previous investments the business angel had conducted prior to the current investment.	Crunchbase
BA: Age (log.)	Age (in years) of the business angel.	Crunchbase, CVs, …
BA: Location US	Dummy variable that captures whether the business angel is from the US (=1) or not (=0).	Crunchbase, CVs, …
Male	Dummy variable that captures whether the business angel is male (=1) or not (=0).	Crunchbase, CVs, …
Education: Business	Business angel has an educational background business or economics (=1) or not (=0).	Crunchbase, CVs, …
Education: Tec/Science	Business angel has an educational background in the field of Tec/Sci (=1) or not (=0).	Crunchbase, CVs, …
Education: PhD	Dummy variable that captures whether the business angel has a PhD (=1) or not (=0).	Crunchbase, CVs, …
Ethnicity: African American	Dummy variable that captures whether the business angel is of African American ethnicity (=1) or not (=0).	Crunchbase, CVs, …
Ethnicity: East Asian	Dummy variable that captures whether the business angel is of East Asian ethnicity (=1) or not (=0).	Crunchbase, CVs, …
Ethnicity: Hispanic	Dummy variable that captures whether the business angel is of Hispanic ethnicity (=1) or not (=0).	Crunchbase, CVs, …
Ethnicity: Indian	Dummy variable that captures whether the business angel is of Indian ethnicity (=1) or not (=0).	Crunchbase, CVs, …
Ethnicity: Middle Eastern	Dummy variable that captures whether the business angel is of Middle Eastern ethnicity (=1) or not (=0).	Crunchbase, CVs, …
Control variables: Twitter level		
Tweets (log.)	The number of messages ("Tweets") a business angel has sent on Twitter (in logged form).	Twitter
Followers (log.)	The number of accounts that follow a business angel ("Followers") on Twitter (in logged form).	Twitter
Follows (log.)	The number of accounts that a business angel follows ("Followees") on Twitter (in logged form).	Twitter
Variables used in sensitivity analyses and further analyses		
Syndicate size	Number of investors involved in the syndicate in four classes: 1, 2–5, 6–10, and 10+.	Crunchbase
Lead investor	Dummy variable that captures whether the business angel was a lead investor (=1) or not (=0).	Crunchbase
Syndicate composition	Captures whether the BA (1) invests alone, (2) with other BAs, (3) with VCs, or (4) with multiple/other investor types.	Crunchbase
Follow-up round	Dummy variable that captures whether the venture received a follow-up round of financing (=1) or not (=0).	Crunchbase
Successful venture exit	Dummy variable that captures whether the venture was acquired or went public (=1) or not (=0).	Crunchbase
Investor exit	Dummy variable that captures whether the business angel eventual exited from the venture (=1) or not (=0).	Crunchbase
Venture survival	Dummy variable that captures whether the venture is active (=1) or closed (=0).	Crunchbase

a founding team, making syndication more likely. However, on the other hand, lone founder ventures typically grow slower than ventures with a founding team, decreasing resource requirements and potentially making syndication less likely. We control for the *venture's number of founders*, which we obtained from Crunchbase.

In line with prior syndication research (e.g., Cumming et al., 2010; De Vries and Block, 2011; Meuleman and Wright, 2011; Sorensen and Stuart, 2008), we control for the *location* of the venture by including two dummy variables that capture whether the venture is headquartered in the US, the EU, or elsewhere in the world. The location and regional environment of the venture influence the market, the political uncertainty and, hence, the investment risk, and they create market opportunities. Supporting this finding, Gu and Lu (2014) find a severe impact of the business and political environment on syndication behavior. In our robustness checks, we also include country dummies for each country in our dataset.

Investments in early venture stages generally entail greater uncertainty and should thus make syndication more likely. Hence, and in line with previous research, we control for venture stage (e.g., Cumming et al., 2010; De Clerq and Dimov, 2008; Gu and Lu, 2014; Hopp and Lukas, 2014). We distinguish two stages based on Crunchbase and include a dummy variable that captures whether a venture is in the *seed stage* (=1) or not (=0).

Finally, we included a set of *year dummies* capturing the year in which the venture received funding and a set of *industry dummies* referring to the industry in which the venture is active. Previous research indicates that both differences over time and across industries, for example, due to different competitive intensities and growth prospects, can impact the syndication behavior (e.g., De Clerq and Dimov, 2008; Ma et al., 2013; Gu and Lu, 2014; Ter Wal et al., 2016).

4.2.4. Control variables (country level)

Cross-cultural research has established that cultural differences play an important role in explaining cross-country differences in the perceptions and behaviors of entrepreneurial finance investors (e.g., Li and Zahra, 2012). One of the most commonly used measures of (national) culture is Hofstede's cultural dimensions framework (Hofstede, 1980), distinguishing between four different dimensions of culture: power distance, individualism, masculinity, and uncertainty avoidance. Dai and Nahata (2016) show that cultural differences are important in explaining VC syndication, particularly in cross-border investments. Similarly, culture is likely to be an important contextual factor for business angel investments and syndication (e.g., Brush et al., 2002; Cumming and Zhang, 2018). For example, business angels in countries with a high uncertainty avoidance might generally have a higher preference to reduce investment risk by syndication. To control for these potential differences in our international sample, we include the cultural dimensions of Hofstede as control variables in our models.

4.2.5. Control variables (business angel level)

We also include a set of control variables at the business angel level. Previous research in the VC domain has consistently shown that previous experience influences the likelihood of syndication. If investors have already undertaken multiple investments, they are less likely to engage in syndication because their experience reduces the uncertainty that they would otherwise seek to reduce via syndication (e.g., Cumming et al., 2010, 2016; Dimov and Milanov, 2010; Gu and Lu, 2014; Hopp and Lukas, 2014). While previous research has focused on VC funds as institutional investors, we expect that this finding also applies to business angels. We thus control for a business angel's number of *previous investments (log.)*, which is calculated based on Crunchbase data.

Additionally, demographic characteristics are likely to influence syndication behavior (e.g., Dimov and Shepherd, 2005; Gompers et al., 2016). First, we account for the age of the respondent by including a variable that captures the business angel's *age* (in years) at the time of the investment decision. Again, previous research has shown that older people tend to be more risk-averse, while a younger age is associated with a higher willingness to take risks (e.g., Hambrick and Mason, 1984). Hence, one could expect that older people are more likely to engage in syndication. We also control for an individual's current location, as syndication behavior might differ across regions. Specifically, we distinguish between business angels located in the US (=1) and elsewhere (=0). Then, we control for an individual's gender. For example, previous research has shown that women, in general, are more risk-averse than men, particularly with regard to financial decision making (Jianakoplos and Bernasek, 1998). Therefore, it could be expected that women are more likely to engage in syndication, and thus we include a dummy variable that captures whether an individual is *male* (=1) or not (=0). Another important individual characteristic is education. Gompers et al. (2016) show that education is very important to a VC's investment behavior. While they focus on differences between top schools, we follow Dimov and Shepherd (2005) and measure the business angel's field of studies. Dimov and Shepherd (2005) show that there are, for example, huge differences in the investment decisions of individuals with backgrounds in entrepreneurship, the sciences, or the humanities. Hence, we capture whether a business angel has an education in business/economics (*education: business*) with a dummy variable. Additionally, we include a dummy variable that captures whether the business angel has a background in Tec/Sci (*education: tec/sci)*, for example, in the fields of computer science, engineering, or chemistry. Also, we capture whether an individual has a *PhD* (=1) or not (=0).

Finally, we include a set of variables to control for the business angels' *ethnicity*. Gompers et al. (2016) find ethnicity to be an important factor in an individual's syndication decisions. We follow Gompers et al. (2016) and Kerr and Lincoln (2010) and use a name-based matching algorithm to determine ethnicity. Similar to Gompers et al. (2016), we account for the region of the business angel's undergraduate academic institution or school as well as other information available in Crunchbase to determine their most likely ethnicity. This approach results in six non-overlapping ethnic groups: African American, East Asian, Hispanic, Indian, Middle Eastern, and all others (mostly White).

4.2.6. Control variables (Twitter level)

Finally, we control for a set of variables at the Twitter level because we want to rule out confounding effects due to different usages of Twitter by the business angels. While novel in the field of entrepreneurial finance, Twitter is used frequently as a data source in psychology (Qiu et al., 2012) and the computer sciences. In the latter, it is used, among other purposes, to study the diffusion of information and communication in networks (e.g., Bakshy et al., 2011; Krishnamurthy et al., 2008; Kwak et al., 2010). This research has consistently used three key variables to characterize Twitter usage that we thus include as control variables: The number of *followers* (i.e., people who subscribe to the account and receive the messages), the number of *followees* (i.e., people whom the users follow themselves and whose messages they receive), and the number of *tweets* (i.e., the messages a user posts on Twitter). These variables were collected directly via the Twitter API at the same time that we collected the Crunchbase data (October 2016). Because of their skewness, we include the Twitter-based variables in log form.

5. Main results

5.1. Descriptive statistics

Descriptive statistics for the full sample are displayed in Table 2, along with the correlations and variance inflation factors. In total, approximately 95% (3,073 of 3,234) of the investments in our sample were syndicated, indicating a strong preference for syndication among business angels. With regard to the Big Five personality traits, the mean values indicate relatively high values in extraversion and neuroticism and comparatively low values in agreeableness.

Notice, however, that the values drawn from Receptivity are scaled differently and should therefore not be compared directly.

With regard to the funded ventures, Table 2 shows that the average venture in our sample raised approximately 1.3 million USD (log. = 14.07) during its first round of investment. With 108 million USD, "Impossible Foods" is the venture in our dataset that raised the most money. The average venture size is 2.2, which corresponds to the group of ventures with 51 to 100 employees. The average number of founders per venture is 2.3 and the ventures were on average 5.6 years old (log. = 1.73), as of 2017. Unsurprisingly, 93% of the ventures were headquartered in the US (Europe: 3%; rest of the world: 4%) and approximately 64% of the ventures in our sample were in a seed stage.

With regard to the cultural dimensions, which could theoretically scale up to 120, the average power distance (40.6) and uncertainty avoidance (46.6) are rather low, while the value of masculinity is moderate (61.7). The value for individualism is high (89.4). These values are biased towards the US because of the dominance of US investors in our sample.

The average business angel has a track record of 4.2 previous investments (log. = 1.44) and is 44 (log. = 3.78) years old. The oldest investor in our dataset was born in 1928, while the youngest investor was born in 1996. Note that these mean values are slightly skewed because business angels that made multiple investments appear multiple times in our dataset.[1] 95% of the business angels are male. Our sample is very US-centric. 92.5% of the observations refer to business angels that are located in the US. The second largest groups are the United Kingdom (2.1%) and India (1.0%). The remaining 4.4% of the observations are from other countries around the world. With regard to their education, 49% of the business angels have a background in business administration or economics, 40% have a background in a technical or scientific field, such as engineering, chemistry, or computer sciences, and 17% have a PhD. Notice that the education classifications are not exclusive. With regard to their ethnicity, 1% of the business angels are African American, 4% are East Asian, 3% are Hispanic, 6% are Indian, 5% Middle Eastern, and approximately 81% are of White ethnicity. These values are roughly comparable to the ratios reported by Gompers et al. (2016).

With regard to Twitter measures, on average, the business angels posted 2,566 Tweets (log. = 7.85), have 10,199 followers (log. = 9.23) and 572 followees (log. = 6.35). Often, the ratio of followers and followees is thus used to measure the influence of Twitter users (e.g., Bakshy et al., 2011; Kwak et al., 2010). Users with a high ratio of followers/followees can be characterized as broadcasters of tweets, while users with a very low ratio have been characterized as miscreants (e.g., spammers or stalkers) or evangelists, who contact everyone they can, and hope that some will follow them (Krishnamurthy et al., 2008).

[1] When correcting for this distortion, the business angels are 43 years old on average, 91% are located in the US, 95% are male, 48% have a background in business, 42% have a background in tec/sci, 11% hold a PhD, 1% are African American, 5% are East Asian, 3% are Hispanic, 7% are Indian, and 6% are of Middle Eastern ethnicity.

5.2. Univariate analysis

To gain a first overview of potential differences between investments that were syndicated and investments that were not syndicated, we perform a univariate *t*-test to assess differences in the mean values between the two groups. In total, 161 investments were not syndicated, while 3,073 investments were syndicated. With regard to the Big Five personality traits, investments that were syndicated are characterized by significantly higher values of extraversion ($p < 0.05$) and significantly lower values of conscientiousness ($p < 0.01$). These differences lend initial support for Hypothesis 2 and Hypothesis 3. However, we find no differences with regard to the remaining personality traits.

With regard to the control variables, Table 3 also reveals several differences. For example, syndication seems to be more likely for investments in which the target venture raised more money, has more employees and founders, is younger, and is US-based. In contrast, syndication is less likely for ventures based in Europe ($p < 0.05$). With regard to Hofstede's cultural dimensions, several highly significant differences emerge. The syndication of ventures seems to be more common in countries with a lower power distance and uncertainty avoidance, while it is more common in countries with higher values in individualism and masculinity ($p < 0.01$). With regard to the control variables at the business angel level, the results show that a higher number of previous investments can be associated with a higher likelihood of syndication ($p < 0.01$). Additionally, several demographic characteristics differ between the two groups: Syndication seems to be significantly more common among business angels who are younger, US-based, or have a PhD. With regard to ethnicity, investors of African American ethnicity tend to engage less in syndication, while investors of East Asian ethnicity seem to engage in syndication more often. Finally, Table 3 indicates that a higher number of Tweets and Followers correlates with a higher likelihood of syndication.

5.3. Logistic regression predicting business angel syndication

Because our dependent variable is binary, we use a logistic regression to analyze the likelihood of syndication and its determinants. Our unit of analysis is the investment. Hence, business angels occur as multiple observations if they performed more than one investment. To account for a potential bias in our estimations, we cluster the standard errors at the business angel level. In total, our analysis comprises 3,234 first-round investments by 1,348 business angels. The results are displayed in Table 4. Our independent variables are entered stepwise in Models 1 to 5 and jointly in Model 6. We do this to assess a potential bias of multicollinearity, even though the low correlations and variance inflation factors displayed in Table 2 indicate that there should be no problems due to multicollinearity. Model 6 also includes the odds ratios and the marginal effects when keeping all other variables at their means to better assess the economic significance of our results.

Hypothesis 1 suggests a positive effect of openness on the likelihood of syndication. While we surprisingly find a negative effect in Model 1, this effect vanishes when the independent variables are entered jointly in Model 6. Hence, the finding is not robust. Conservatively speaking, we find no support for Hypothesis 1. Hypothesis 2 suggests a positive relationship between extraversion and syndication. As shown in Models 2 and 6, we find a highly significant and positive effect ($p < 0.01$), indicating that individuals with higher values in extraversion tend to engage in syndication more often. The odds ratio of 1.39 indicates that an increase in extraversion by one unit increases the odds of syndication by 39%. The marginal effect of 0.005 indicates that a one-unit increase in extraversion increases the probability of syndication by 0.5%. Finally, Hypothesis 3 posits a negative relationship between conscientious-

Table 2
Descriptive statistics, correlations, and variance inflation factors.
This table presents the means, standard deviations, minimum values, and maximum values for the variables used in our main analyses. This table also displays the pairwise correlations between the variables (values below −0.05 or above 0.05 are significant at the level of 5%). The last column displays the variance inflation factors (VIF), which are estimated based on Model 6 in Table 4. The total number of observations is 3,234 investments from 1,348 business angels. All variables are defined in Table 1. The reference category for the venture's location dummies is "Venture: Location rest of the world". The reference category for the education dummies is "Education: Other/unknown". The reference category for ethnicity dummies is "Ethnicity: Other".

	AM	SD	Min	Max	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)	(23)	(24)	(25)	(26)	(27)	(28)	(29)	(30)	(31)	VIF
Dependent Variable																																				
(1) Syndication	0.95	0.22	0.00	1.00																																1.14
IV: Big Five																																				
(2) Openness	2.21	1.04	-1.57	5.56	-0.02																															1.53
(3) Extraversion	3.66	1.38	-0.23	7.44	0.04	-0.26																														2.36
(4) Conscientiousness	1.72	1.30	-1.58	5.72	-0.06	0.33	0.35																													2.21
(5) Agreeableness	0.39	2.17	-7.12	4.68	-0.02	-0.09	0.65	0.47																												2.20
(6) Neuroticism	3.92	2.15	-3.08	11.56	0.00	0.21	-0.57	-0.46	-0.50																											2.02
CV: Venture level																																				
(7) Amount raised (log.)	14.07	1.23	6.91	18.50	0.28	0.06	0.05	0.03	0.02	0.00																										1.50
(8) Venture: Age (log.)	1.73	0.41	0.00	3.30	-0.02	0.02	-0.03	0.02	-0.03	0.02	-0.02																									2.77
(9) Venture: No. of emp.	2.23	1.30	1.00	7.00	0.05	0.02	0.01	0.03	0.01	0.02	0.27	0.23																								1.28
(10) Venture: No. of founders	2.26	1.07	1.00	9.00	0.07	0.02	-0.01	0.02	0.00	0.00	0.02	-0.07	0.08																							1.05
(11) Venture: Location US	0.93	0.25	0.00	1.00	0.03	-0.01	-0.01	-0.02	-0.02	0.02	0.08	0.05	0.00	-0.02																						2.01
(12) Venture: Location EU	0.03	0.17	0.00	1.00	-0.03	0.00	0.01	0.00	0.02	-0.01	-0.07	-0.01	0.02	0.02	-0.65																					1.91
(13) Round: Seed-stage	0.64	0.48	0.00	1.00	0.00	-0.04	-0.03	-0.06	-0.03	0.03	-0.25	-0.32	-0.22	0.00	0.00	-0.01																				1.33
CV: Country level																																				
(14) Hofstede: PD	40.62	5.73	13.00	93.00	-0.05	0.02	0.07	0.04	0.08	-0.07	-0.08	-0.09	-0.01	0.02	-0.14	-0.02	0.00																			2.87
(15) Hofstede: Individualism	89.35	7.91	20.00	91.00	0.05	-0.02	-0.02	-0.02	-0.07	0.05	0.10	0.08	0.01	-0.02	0.24	-0.11	0.00	-0.75																		5.77
(16) Hofstede: Masculinity	61.65	3.87	5.00	95.00	0.08	-0.03	0.01	-0.02	-0.03	0.03	0.07	0.04	0.03	-0.01	0.13	-0.09	0.03	-0.28	0.40																	1.22
(17) Hofstede: UA	46.59	6.19	23.00	99.00	-0.05	0.05	-0.04	0.05	0.02	-0.02	-0.06	-0.01	-0.01	0.03	-0.04	0.07	0.02	0.43	-0.53	-0.24																1.55
CV: Investor level																																				
(18) Previous inv. (log.)	1.44	1.39	0.00	5.28	0.12	0.06	-0.10	0.00	-0.15	0.18	0.20	-0.16	-0.02	0.04	-0.07	0.05	0.04	-0.04	0.09	0.04	-0.08															1.57
(19) BA: Age (log.)	3.78	0.21	3.04	4.47	-0.02	0.08	-0.01	0.23	0.03	-0.07	0.08	0.21	0.03	-0.03	0.02	-0.01	-0.13	-0.07	0.07	0.04	-0.04	0.09														1.32
(20) BA: Residence US	0.93	0.26	0.00	1.00	0.06	-0.02	-0.04	-0.01	-0.06	0.03	0.09	0.07	0.03	-0.02	0.34	-0.26	-0.02	-0.38	0.73	0.31	-0.34	0.11	0.07													2.82
(21) Male	0.95	0.21	0.00	1.00	-0.02	0.09	-0.12	0.03	-0.08	0.02	-0.02	0.00	0.01	0.01	0.01	-0.02	0.02	0.03	-0.04	-0.03	0.04	0.01	-0.10	-0.03												1.09
(22) Education: Business	0.49	0.50	0.00	1.00	-0.02	0.02	0.08	0.13	0.17	-0.04	-0.02	0.03	0.02	-0.01	-0.05	0.05	0.00	0.04	-0.04	-0.02	0.05	0.01	0.09	-0.01	0.02											1.21
(23) Education: Tec/Sci	0.40	0.49	0.00	1.00	0.02	0.04	-0.14	-0.05	-0.04	0.00	-0.04	-0.05	-0.03	0.05	-0.04	0.00	0.04	0.10	-0.06	-0.03	0.02	-0.04	0.00	-0.03	0.10	-0.22										1.34
(24) Education: PhD	0.17	0.38	0.00	1.00	0.04	-0.01	0.03	-0.02	-0.05	0.06	0.05	0.04	0.02	-0.02	0.07	-0.05	-0.02	-0.02	0.05	0.03	-0.03	0.18	0.10	0.07	-0.02	-0.14	-0.22									1.23
(25) Ethnicity: Afr. American	0.01	0.11	0.00	1.00	-0.07	0.01	-0.01	-0.02	0.01	-0.01	-0.04	-0.03	-0.01	0.00	0.03	-0.02	0.03	0.01	0.00	0.01	-0.01	-0.04	-0.01	0.02	0.01	-0.08	-0.06	-0.05								1.09
(26) Ethnicity: East Asian	0.04	0.21	0.00	1.00	0.03	-0.01	-0.05	0.01	-0.01	-0.01	0.01	-0.06	0.00	-0.01	0.02	-0.03	0.04	-0.01	0.02	0.06	0.01	-0.05	-0.15	0.04	-0.04	-0.01	0.10	0.02	-0.02							1.10
(27) Ethnicity: Hispanic	0.03	0.16	0.00	1.00	0.00	-0.05	0.08	-0.07	0.08	-0.04	0.02	-0.01	-0.01	0.00	0.02	-0.03	0.01	0.04	-0.06	-0.01	0.04	-0.01	-0.08	0.00	0.03	0.05	-0.03	-0.05	-0.02	-0.04						1.08
(28) Ethnicity: Indian	0.06	0.25	0.00	1.00	0.01	-0.03	0.09	-0.01	0.12	-0.07	-0.03	-0.07	0.02	0.02	-0.10	-0.02	0.04	0.22	-0.17	-0.03	-0.08	-0.08	-0.09	-0.11	0.02	0.02	0.14	-0.03	-0.03	-0.06	-0.04					1.20
(29) Ethnicity: Middle Eastern	0.05	0.22	0.00	1.00	0.01	0.12	-0.04	0.06	-0.01	0.07	-0.04	0.01	-0.01	0.01	0.01	-0.03	0.01	0.03	-0.11	-0.05	0.09	-0.03	-0.02	-0.03	0.04	0.02	0.12	-0.03	-0.03	-0.05	-0.04	-0.06				1.11
CV: Twitter level																																				
(30) Tweets (log.)	7.85	1.74	3.18	11.86	0.06	-0.05	-0.19	-0.34	-0.36	0.30	0.01	-0.02	0.00	0.00	-0.03	0.00	0.06	-0.03	-0.01	0.02	-0.03	0.26	-0.12	-0.03	-0.04	-0.11	-0.11	0.18	0.05	0.02	0.01	-0.06	0.00			2.81
(31) Followers (log.)	9.23	2.34	2.30	18.20	0.07	-0.01	-0.04	-0.12	-0.18	0.20	0.20	0.02	0.09	0.03	-0.02	-0.02	-0.03	-0.01	0.02	0.02	-0.06	0.47	0.05	0.04	-0.06	-0.08	-0.16	0.18	0.12	-0.03	0.05	-0.09	0.01	0.61		2.26
(32) Follows (log.)	6.35	1.40	1.61	16.57	0.02	-0.09	-0.03	-0.15	-0.17	0.05	-0.05	-0.02	-0.04	-0.01	-0.02	-0.03	0.06	-0.06	0.04	0.03	-0.09	0.11	-0.02	-0.01	-0.09	-0.10	-0.04	0.02	-0.01	0.01	0.01	-0.04	-0.03	0.61	0.35	1.75

Table 3
Univariate analysis.
This table displays the mean and standard deviation of each variable for the subgroup of investments without syndication and for the subgroup of investments with syndication. The final column displays the difference in the mean values as well as a *t*-test for the equality of the mean values. The total number of observations is 3,234 investments from 1,348 business angels. All variables are defined in Table 1. Significance levels are denoted by asterisks, *** 1%, ** 5%, and * 10% (p -values are two-tailed).

	Syndication = 0 (N = 161)		Syndication = 1 (N = 3,073)		*t*-test
Variables	*Mean*	*SD*	*Mean*	*SD*	(0) vs. (1)
IV: Big Five					
Openness	2.313	0.978	2.210	1.047	0.104
Extraversion	3.421	1.342	3.678	1.385	−0.256**
Conscientiousness	2.045	1.284	1.699	1.302	0.346***
Agreeableness	0.564	1.978	0.382	2.176	0.182
Neuroticism	3.899	2.452	3.917	2.138	−0.019
CV: Venture level					
Amount raised (log.)	12.581	1.667	14.145	1.146	−1.564***
Venture: Age (log.)	1.770	0.465	1.731	0.0411	0.039
Venture: No. of employees	1.926	1.212	2.242	1.302	−0.316***
Venture: No. of founders	1.926	1.159	2.281	1.067	−0.355***
Venture: Location US	0.894	0.308	0.934	0.248	−0.040**
Venture: Location EU	0.056	0.230	0.029	0.167	0.027**
Round: Seed-stage	0.627	0.627	0.636	0.481	−0.008
CV: Country level					
Hofstede: Power distance	41.851	10.781	40.560	5.333	1.291***
Hofstede: Individualism	87.460	11.729	89.450	7.652	−1.991***
Hofstede: Masculinity	60.379	8.007	61.722	3.507	−1.343***
Hofstede: Uncertainty avoidance	47.994	11.159	46.519	5.808	1.474***
CV: Investor level					
Previous inv. (log.)	0.699	0.699	1.483	1.394	−0.784***
BA: Age (log.)	3.801	3.801	3.779	0.205	0.022
BA: Residence US	0.857	0.857	0.929	0.257	−0.072***
Male	0.969	0.969	0.954	0.209	0.015
Education: Business	0.534	0.534	0.486	0.500	0.048
Education: Tec/Sci	0.354	0.354	0.404	0.491	−0.050
Education: PhD	0.106	0.106	0.174	0.379	−0.069**
Ethnicity: African American	0.044	0.043	0.010	0.098	0.034***
Ethnicity: East Asian	0.019	0.019	0.046	0.210	−0.028*
Ethnicity: Hispanic	0.025	0.025	0.027	0.161	−0.002
Ethnicity: Indian	0.056	0.056	0.065	0.247	−0.009
Ethnicity: Middle Eastern	0.044	0.043	0.054	0.225	−0.010
Ethnicity: White	0.814	0.391	0.799	0.401	0.015
CV: Twitter level					
Tweets (log.)	7.420	7.420	7.877	1.740	−0.456***
Followers (log.)	8.535	8.534	9.264	2.322	−0.730***
Follows (log.)	6.251	6.251	6.355	1.398	−0.103

ness and syndication. Again, our results support this hypothesis by showing a highly significant negative effect ($p < 0.01$). The odds ratio of 0.73 indicates that a one-unit increase in conscientiousness decreases the odds of syndication by 27%, while the marginal effect indicates that the overall probability of syndication decreases by 0.5%. We find no support for Hypothesis 4 or 5.

Multiple control variables have a significant effect on syndication. Based on Model 6, syndication is more common for ventures that raised more money. This is in line with previous research indicating that sharing the financial risk, which is higher if the investment is higher, is one of the main drivers of syndication (e.g., Cumming et al., 2005; De Clerq and Dimov, 2004, 2008). Additionally, we find that syndication is more common among ventures with a higher number of founders and among ventures in the seed stage. Interestingly, we also find that higher levels of country level power distance and individualism decrease the likelihood of syndication, while higher values of masculinity increase the likelihood of syndication.[2] With regard to the investor level, we find that a higher number of previous investments increases the likelihood of syndication, as does a younger age and an educational background in the field of science or technology. Ethnicity does not influence syndication significantly.

6. Sensitivity analyses

We perform several sensitivity analyses to investigate the robustness of our main findings. These sensitivity analyses comprise changes in estimation techniques, changes to our sample, changes in the dependent variables, and a dedicated assessment of a potential endogeneity bias. To keep the manuscript more concise, we included the respective tables in the Appendix.

6.1. Penalized likelihood estimation to account for rare events

In total, 95% of the investments in our sample were syndicated. Hence, non-syndicated investments are comparatively rare. Logistic regression suffers from estimation problems in the case of rare events (i.e., one group of observations is extremely rare). This is because the maximum likelihood estimation used in logistic regressions suffers from a small-sample bias, with the degree of the bias depending on the number of rare observations. There are several methods to account for potential estimation problems with rare events, which we include as robustness checks in this study. The common solution to this problem is the so-called “Firth method”, which uses a penalized likelihood estimation to reduce

[2] To ensure the robustness of our results, we also estimated the same model with country dummies (not reported). The main results remain unchanged and can be obtained from the corresponding author.

Table 4
Main analysis: Logistic regression on the determinants of syndication.
This table shows the results of our main analysis. We perform a logistic regression with the dependent variable syndication (dummy). We perform a logistic regression with the dependent variable syndication (dummy). All variables are defined in Table 1. Logits are reported with robust standard errors (SE) clustered by business angels in parentheses. . The reference category for the venture's location dummies is "Venture: Location rest of the world". The reference category for the education dummies is "Education: Other/unknown". The reference category for ethnicity dummies is "Ethnicity: Other". Significance levels are denoted by asterisks, *** 1%, ** 5%, and * 10% (p-values are two-tailed).

	Model 1		Model 2		Model 3		Model 4		Model 5		Model 6			
Variables	*Logit*	*(SE)*	*Logit*	*SE*	*Logit*	*SE*	*Logit*	*SE*	*Logit*	*SE*	*Logit*	*SE*	*OR*	*ME*
CV: Venture level														
Amount raised (log.)	0.912	(0.082)***	0.905	(0.081)***	0.898	(0.082)***	0.902	(0.081)***	0.903	(0.081)***	0.899	(0.081)***	2.457	0.014
Venture: Age (log.)	0.395	(0.421)	0.416	(0.412)	0.400	(0.425)	0.414	(0.425)	0.434	(0.422)	0.416	(0.413)	1.516	0.007
Venture: No. of employees	0.002	(0.081)	0.004	(0.080)	−0.001	(0.081)	0.000	(0.080)	0.007	(0.081)	0.009	(0.082)	1.009	0.000
Venture: No. of founders	0.422	(0.133)***	0.418	(0.133)***	0.423	(0.132)***	0.419	(0.133)***	0.421	(0.133)***	0.433	(0.136)***	1.543	0.007
Venture: Location US	0.362	(0.477)	0.403	(0.482)	0.335	(0.480)	0.379	(0.480)	0.422	(0.482)	0.386	(0.485)	1.471	0.007
Venture: Location EU	0.195	(0.596)	0.192	(0.590)	0.142	(0.601)	0.206	(0.601)	0.232	(0.601)	0.118	(0.591)	1.125	0.002
Round: Seed-stage	0.408	(0.188)**	0.451	(0.190)**	0.405	(0.186)**	0.419	(0.186)**	0.427	(0.188)**	0.453	(0.194)**	1.573	0.008
CV: Country level														
Hofstede: Power distance	−0.023	(0.020)	−0.030	(0.020)	−0.026	(0.020)	−0.025	(0.020)	−0.024	(0.020)	−0.035	(0.020)*	0.966	−0.001
Hofstede: Individualism	−0.033	(0.021)	−0.037	(0.021)*	−0.034	(0.020)*	−0.033	(0.020)*	−0.032	(0.021)	−0.040	(0.021)*	0.961	−0.001
Hofstede: Masculinity	0.037	(0.017)**	0.037	(0.016)**	0.038	(0.016)**	0.038	(0.016)**	0.039	(0.017)**	0.038	(0.017)**	1.039	0.000
Hofstede: Uncertainty avoidance	−0.010	(0.013)	−0.007	(0.012)	−0.009	(0.012)	−0.011	(0.012)	−0.010	(0.013)	−0.002	(0.012)	0.998	−0.000
CV: Investor level														
Previous inv. (log.)	0.434	(0.087)***	0.465	(0.097)***	0.430	(0.085)***	0.436	(0.089)***	0.450	(0.089)***	0.462	(0.091)***	1.587	0.007
BA: Age (log.)	−1.333	(0.467)***	−1.236	(0.452)***	−1.187	(0.502)**	−1.389	(0.463)***	−1.417	(0.465)***	−0.852	(0.467)*	0.427	−0.013
BA: Residence US	0.632	(0.472)	0.757	(0.482)	0.677	(0.473)	0.650	(0.479)	0.636	(0.482)	0.826	(0.475)*	2.285	0.019
Male	−0.296	(0.528)	−0.202	(0.508)	−0.300	(0.566)	−0.360	(0.516)	−0.377	(0.499)	−0.124	(0.568)	0.883	0.002
Education: Business	−0.087	(0.212)	−0.141	(0.210)	−0.058	(0.218)	−0.095	(0.217)	−0.102	(0.210)	−0.075	(0.211)	0.928	−0.001
Education: Tec/Sci	0.301	(0.218)	0.335	(0.215)	0.327	(0.216)	0.319	(0.216)	0.299	(0.214)	0.334	(0.210)	1.396	0.005
Education: PhD	0.457	(0.318)	0.384	(0.314)	0.443	(0.318)	0.438	(0.312)	0.442	(0.311)	0.321	(0.321)	1.379	0.005
Ethnicity: African American	−0.683	(0.641)	−0.724	(0.610)	−0.691	(0.659)	−0.696	(0.629)	−0.782	(0.615)	−0.757	(0.664)	0.469	−0.017
Ethnicity: East Asian	0.911	(0.800)	0.866	(0.757)	0.964	(0.818)	0.870	(0.787)	0.837	(0.788)	1.032	(0.805)	2.805	0.011
Ethnicity: Hispanic	0.093	(0.554)	0.049	(0.557)	0.137	(0.579)	0.131	(0.553)	0.106	(0.543)	0.053	(0.602)	1.054	0.001
Ethnicity: Indian	0.179	(0.598)	0.149	(0.576)	0.219	(0.595)	0.199	(0.611)	0.201	(0.596)	0.272	(0.540)	1.313	0.004
Ethnicity: Middle Eastern	0.484	(0.472)	0.454	(0.465)	0.514	(0.481)	0.463	(0.476)	0.494	(0.460)	0.629	(0.464)	1.876	0.008
CV: Twitter level														
Tweets (log.)	0.227	(0.113)**	0.269	(0.104)***	0.180	(0.134)	0.225	(0.122)*	0.251	(0.110)**	0.205	(0.109)*	1.228	0.003
Followers (log.)	−0.162	(0.096)*	−0.176	(0.081)**	−0.147	(0.107)	−0.158	(0.096)*	−0.156	(0.084)*	−0.160	(0.085)*	0.852	−0.003
Follows (log.)	−0.041	(0.079)	−0.060	(0.082)	−0.021	(0.080)	−0.041	(0.080)	−0.060	(0.082)	−0.036	(0.080)	0.965	0.001
IV: Big Five														
Openness	−0.164	(0.093)*									0.058	(0.108)	1.059	0.001
Extraversion			0.217	(0.089)**							0.333	(0.105)***	1.394	0.005
Conscientiousness					−0.176	(0.095)*					−0.312	(0.098)***	0.732	−0.005
Agreeableness							−0.000	(0.054)			−0.084	(0.070)	0.919	−0.001
Neuroticism									−0.081	(0.053)	−0.070	(0.056)	0.932	−0.001
Year dummies (8 variables)	Yes		Yes		Yes		Yes		Yes		Yes			
Industry dummies (21 variables)	Yes		Yes		Yes		Yes		Yes		Yes			
Observations (clusters)	3,234	(1,348)	3,234	(1,348)	3,234	(1,348)	3,234	(1,348)	3,234	(1,348)	3,234	(1,348)		
Pseudo-R^2	0.268		0.273		0.270		0.265		0.268		0.286			
Classified correctly (%)	95.269		95.362		95.269		95.269		95.207		95.393			
Log Likelihood	−468.543		−465.376		−467.344		−470.089		−468.276		−456.936			
Chi^2 (sig.)	308.008	***	305.274	***	300.638	***	299.368	***	299.707	***	323.516	***		

the small-sample bias and produces finite, consistent estimates of regression parameters (King and Zeng, 2001).

We perform a penalized likelihood estimation using the Firth method as our first sensitivity analysis. The results are displayed in the Appendix. Model 1 of Table A1 shows that there are no severe differences from the standard logistic regression. Both the effects of extraversion and conscientiousness on the likelihood of syndication remain highly significant ($p < 0.01$). Note, however, that the Firth method does not allow for clustered standard errors.

6.2. Excluding tweets that are not work-related

In another sensitivity analysis, we exclude business angels whose Tweets are not work-related, because the language (and thus, our personality scores) might differ between people who often talk about work and people who rarely talk about work. To perform this analysis, we obtained additional data from Receptiviti, which includes a dimension that measures the degree to which an individual talks about leisure activities ("leisure orientation"). Low scores in leisure orientation can be seen as a proxy for a higher work orientation.

We then perform a median split according to this variable and re-estimate our main analysis with the 50% of business angels who have the lowest leisure orientation (and thus a higher work orientation). While the results reported in Model 2 (Table A1) lose significance because of the strongly reduced sample size (now 1,647 investments by 641 business angels), the effects of extraversion and conscientiousness remain significant ($p < 0.1$), underlining the robustness of our main findings.

6.3. Excluding celebrities

Our sample includes various celebrities. These celebrities include "super angels" such as Frabice Grinda, with a total of 199 investments and approximately 10,000 followers on Twitter; Ron Conway, with a total of 128 investments and 96,000 followers; and Alexis Ohanian with 118 investments and 141,000 followers. However, our sample also includes famous musicians and actors, led by musician Justin Bieber, who has more than 92 million follow-

ers on Twitter but also made two investments as a business angel. Other famous business angels include Microsoft founder Bill Gates and actor Ashton Kutcher. It can be argued that celebrities as business angels differ in their representation on Twitter, mainly because they have a vastly different target audience than "professional" business angels.

To account for a potential bias, we exclude all individuals with more than 500,000 followers, reducing our sample to 3,036 investments by 1,296 individuals (Model 3, Table A1). The results pertaining to the effects of extraversion and conscientiousness remain robust.

6.4. Excluding later-stage investments

As a further sensitivity analysis, we reduce our sample to investments in seed-stage ventures only. Because business angels often invest in the earliest stages of the venture cycle (e.g., Cumming and Zhang, 2018; Dutta and Folta, 2016), it is particularly important to assess whether our results pertain in this setting.

Model 4 (Table A1) shows the results of our main analysis in this reduced sample. While the positive influence of extraversion on syndication persists, the effect of conscientiousness becomes insignificant. This indicates that the effect of conscientiousness is particularly pronounced in the later stages. An explanation might be that in the later stages, more information is available for investors to assess a venture's quality. Hence, syndication loses its importance as a vehicle to reduce investment risk, particularly for conscientious individuals who carefully evaluate this additional information provided by the venture.

6.5. Accounting for different compositions at the syndicate level

Previous research on business angel investments has highlighted the importance of the syndicate composition. For example, Gompers et al. (2016) highlight the importance of similarities between personal characteristics in syndication and their effects on subsequent investment performance. They find that investors who share the same ethnic, educational, or career background are more likely to syndicate with each other.

To rule out a potential bias due to differences between syndicates instead of individuals, we aggregate business angels' personality traits at the syndicate level and construct a mean value for every syndicate. We then re-estimate our main model with these syndicate-level scores. The results are reported in Model 5 (Table A1), which also includes standard errors clustered at the syndicate level. The results underline the robustness of our main results. Both extraversion and conscientiousness remain highly significant determinants of syndication ($p < 0.1$). Note that we explore the topic of syndicate composition further in Section 7.

6.6. Accounting for a potential endogeneity bias

We argue that personality drives syndication. While research in psychology often describes the Big Five to be relatively stable across time, we cannot rule out that syndication influences how individuals present themselves on Twitter, thereby influencing the personality scores (and the language used in Twitter). To address this potential reverse causality and endogeneity bias, we collect large amounts of additional data to perform several sensitivity analyses. We start by downloading all available Twitter statements by the business angels in our sample and divide these statements according to whether they occurred before or after an individual's first syndication. Then, we calculate two personality scores for each business angel: the first one is based on the Tweets that occurred before the first syndication, and the second is based on the Tweets that occurred after the first syndication. This approach enables us to analyze whether syndication influences our Twitter-based measures of personality.

Our sample decreases in size for multiple reasons. First, we were not able to calculate scores before syndication for every individual because (1) some individuals engaged in syndication before they became active on Twitter, (2) Twitter only allows the retrieval of the latest 3,200 Tweets per individual (i.e., for individuals who are very active on Twitter, we were not able to determine a score before syndication because of the many Tweets that occurred after their first syndication), and (3) we were only able to calculate before and after personality scores for those businesses where we had at least 300 words before and 300 words after syndication. In total, our sample is reduced to 829 investments by 572 business angels.

In the regression results displayed in Table A2 (Appendix), our dependent variables are the Twitter-based personality scores after syndication. Our main independent variable is the syndication dummy, and our control variables are the same as in previous regressions. Furthermore, we control for the respective personality scores before syndication. The syndication dummy is insignificant for all personality measures except for agreeableness, making reverse causality an unlikely explanation for our main findings regarding the effects of extraversion and conscientiousness.

To further explore a potential endogeneity bias, we performed a propensity score matching (PSM) using Stata's "psmatch2" command and performed a single nearest-neighbor matching without replacement. We included all venture characteristics as confounders (independent variables). The PSM thus identified the 161 deals with syndication that were the most similar to the 161 deals without syndication using the independent variables 'amount raised (log.)', 'venture: age (log.)', 'venture: no. of employees', 'venture: no. of founders', 'venture: location US', 'venture: location EU', and 'round: seed-stage'. We then compared the mean values in both groups (Table not shown but available from the corresponding author). The comparison shows that syndicated deals show significantly higher values in extraversion than non-syndicated deals, further underlining the robustness of our result pertaining to extraversion. However, the values for conscientiousness do not differ significantly between the groups, possibly because of the small sample size.

6.7. Accounting for differences across countries and states

While our sample is US-centric (92.5% of the business angels are US-based), differences across countries might influence syndication behavior. Since prior research suggests that culture is likely to be an important contextual factor for business angel investments and syndication (e.g., Brush et al., 2002; Cumming and Zhang, 2018; Dai and Nahata, 2016), we include the cultural dimensions of Hofstede as control variables in our models.

To rule out any confounding influences of culture on syndication, we conduct multiple robustness checks that are reported in the Appendix (Table A3). Model 1 displays a reassessment of the main analysis that includes country dummies to account for any differences across countries. Model 2 displays a subsample analysis that only considers business angels located in the US. Both models underline the robustness of the main results.

Model 3 focusses on ventures located in the US. To rule out differences in the syndication behavior according to the region where the target venture is located, we control for whether the venture is located in San Francisco (including Palo Alto, Mountain View) or New York. The reference category for the venture's location dummies is "Venture: Location rest of the US". The main results do not change. Interestingly, we find that syndication is more likely for San Francisco-based ventures and less likely for targets located in New York.

7. Further exploratory analyses

In these further explanatory analyses, we change the dependent variable and assess how a business angel's personality influences various important outcome variables.

7.1. Further analyses regarding syndicate size, lead investor and syndicate composition

This section focuses on whether and how business angels' personalities influence different syndicate characteristics, such as the syndicate size, hierarchy, and composition.

Previous research in the VC context has investigated the determinants of syndicate size (e.g., Cumming et al., 2005; De Vries and Block, 2011). Analogously, we investigate how business angel personality relates to the size of the syndicate. To this end, we construct an ordinal variable *syndicate size* consisting of four different classes: (1) "Syndicates" with a size of 1 (=the angel investors alone) (5.0% of observations); (2) syndicates with 2 to 5 investors (46.1% of observations); (3) syndicates with 6 to 10 investors (32.2% of observations); and (4) syndicates with more than 10 investors (16.7% of observations). To investigate the effect of business angel personality on syndicate size, we estimate a multinomial logistic regression with (1) as the base group. The results are displayed in Table 5, Model 1. In line with our prior findings, the results show that investors higher in extraversion have a general preference for syndication, irrespective of the syndicate size. Likewise, investors who are higher in conscientiousness have a lower preference for syndication, irrespective of the syndicate size. This supports our main findings and illustrates that further distinguishing between small and large syndicates does not alter our main findings. However, the results reveal further interesting patterns. For example, the effect of extraversion decreases in magnitude and significance with increasing syndicate size, whereas the effect of conscientiousness increases in magnitude and becomes more negative with the increasing syndicate size.

Since the variable *syndicate size* is ordinal, an ordered logistic regression would be another alternative. However, using an ordered logit model requires that the assumption of proportional odds is not violated. We thus performed an approximate likelihood-ratio test of proportionality of odds across response categories using Stata's "omodel" command. The test indicates that the assumption is violated and that a standard ordered logit model is inappropriate. Hence, we used a generalized ordered logit model which does not rely on the assumption of proportional odds. The results are reported in Table A4 in the Appendix. The results show that the effects of extraversion and conscientiousness are mainly due to the first group (deals without syndication), underlining the robustness of our main results. However, the nuances between groups are not as pronounced as in the multinomial ordered logistic regression. While the group between 2 to 5 investors has lower conscientiousness, personality does not seem to impact syndication in larger syndicates. Please also note that the largest group is left out of the model as a reference group.

Another important characteristic of a syndicate is the presence of a lead investor. The lead investor signals to syndicate partners that he or she fully backs the deal with his or her reputation, often has the largest equity stake in the syndicate, and often invites follow-on investors to the syndicate (Gompers et al., 2016; Lockett and Wright, 2001; Manigart et al., 2006). Our dataset enables us to analyze whether a business angel's personality correlates with being a lead investor. For example, one could expect extraverted business angels to take on this role more often than other business angels because of their outgoing social personality. To test this idea, we collect additional information on lead investor status from Crunchbase and constructed the dummy variable *lead investor*, which captures whether a particular business angel acts as lead investor (=1) or not (=0). Unfortunately, this information is not disclosed for every investment. Overall, we can determine the lead investor status for 893 syndicated deals. We then estimate a logistic regression (Table 5, Model 2) with the variable lead investor as the dependent variable. The results do not indicate a relationship between business angel personality and lead investor status.

Finally, there are multiple investor types involved in syndication. These include business angels, VC firms, corporate VCs, and others. While our main analysis does not distinguish between investor types, the business angel personality might also influence the composition of the type of other partners that are part of the syndicate. For example, business angels low in conscientiousness could be particularly likely to enter a syndicate together with a VC firm, which typically has many resources to conduct a careful venture screening and selection. Therefore, we construct a categorical variable *syndicate composition* from Crunchbase, which considers whether the business angel invests (1) alone, (2) together with other business angels, (3) together with VC funds, or (4) together with other business angels and/or VCs and/or other entities (e.g., corporate VCs). We estimate a multinomial regression, and the results are displayed in Table 5, Models 3 to 5. The results reveal significant effects for both extraversion and conscientiousness across all three models. This underlines that extraversion increases the likelihood of syndication and conscientiousness reduces the likelihood of syndication, irrespective of the composition of the syndicate.

7.2. Further analyses regarding venture success and business angel exit

An interesting question is whether and how business angel personality relates to venture success. Even though the mechanisms between personality and investment success are less clear and often indirect, prior research has identified that some personality traits are correlated with investment success. For example, Durand et al. (2008) find an effect of extraversion on the portfolio performance of an investor. To explore the relation between business angel personality and investment or venture success, we construct several proxies.

Our first measure is the venture's ability to attract a second round of funding (e.g., Ter Wal et al., 2016). We collect additional data from Crunchbase on the presence of follow-up funding rounds. The dummy variable *follow-up round* captures whether a second funding round exists (=1) or not (=0). In Table 6, Model 1, we estimate a logistic regression with *follow-up round* as the dependent variable. The results show that while syndication, amount raised, and the individual age of the business angel are correlated with the existence of a follow up round, business angel personality does not seem to have a significant effect.

Another established criterion of venture success is whether a successful exit via a trade sale or an IPO occurred (Tian, 2012). The variable *successful venture exit* captures this situation and indicates whether the venture was acquired or went public (=1) or not (=0). Data on this variable is obtained from Crunchbase and was collected as of January 2018. Similar to the previous models, we do not find a significant correlation between business angel personality and venture success (Table 6, Model 2).

Next to a successful exit via trade sale or IPO, we consider the respective business angel's exit from the venture as another important outcome variable (Cumming et al., 2016). Data on business angel exits are from Crunchbase; the variable *business angel exit* captures whether the business angel exited the venture before January 2018 (=1) or not (=0). Unfortunately, Crunchbase does not specify the exact method of exit. Again, the results indicate that per-

Table 5
Further analyses on syndicate characteristics.
This table shows multiple analyses that explore the relation between personality and syndicate size, hierarchy, and composition. Models 1 to 3 display the results of a multinomial regression with different syndicate sizes as the dependent variable. The comparison group are investments with a syndicate size of 1 (no syndication took place). Model 4 displays the results of logistic regression with lead investor as the dependent variable. Models 5 to 7 display the results of a multinomial regression with different syndicate compositions as the dependent variable. The comparison group are investments with where the investor invests alone. All variables are defined in Table 1. Coefficient are reported with robust standard errors clustered by business angels in parentheses. Significance levels are denoted by asterisks, *** 1%, ** 5%, and * 10% (p -values are two-tailed).

Dependent variable	Model 1 Syndicate size: 2–5		Syndicate size: 6–10		Syndicate size: 10+		Model 2 Lead investor		Model 3 Syn. composition: Only BAs		Model 4 Syn. composition: BAs and VCs		Model 5 Syn. Composition: BAs and others	
Variables	Logit	*(SE)*	*Logit*	*SE*	*Logit*	*SE*	*Logit*	*SE*	*Logit*	*(SE)*	*Logit*	*SE*	*Logit*	*SE*
CV: Venture level														
Amount raised (log.)	0.755	(0.083)***	1.040	(0.084)***	1.550	(0.102)***	−1.145	(0.109)***	0.315	(0.084)***	1.277	(0.095)***	1.264	(0.114)***
Venture: Age (log.)	0.344	(0.425)	0.936	(0.433)**	−0.508	(0.453)	−0.061	(0.431)	0.580	(0.467)	0.334	(0.429)	0.632	(0.473)
Venture: No. of employees	0.023	(0.082)	−0.032	(0.088)	0.046	(0.089)	−0.061	(0.097)	0.091	(0.087)	−0.043	(0.083)	0.004	(0.106)
Venture: No. of founders	0.416	(0.135)***	0.468	(0.138)***	0.357	(0.140)**	−0.030	(0.098)	0.294	(0.134)**	0.499	(0.144)***	0.468	(0.158)***
Venture: Location US	0.156	(0.479)	1.180	(0.529)**	0.245	(0.568)	−0.047	(0.499)	−0.087	(0.500)	0.489	(0.490)	2.440	(0.999)**
Venture: Location EU	0.114	(0.582)	0.593	(0.671)	−16.274	(0.716)***	0.680	(0.665)	0.009	(0.670)	0.210	(0.595)	2.167	(1.133)*
Round: Seed-stage	0.259	(0.198)	0.788	(0.208)***	0.735	(0.223)***	−1.623	(0.233)***	0.028	(0.216)	0.623	(0.198)***	0.705	(0.247)***
CV: Investor level														
Previous inv. (log.)	0.496	(0.092)***	0.397	(0.093)***	0.359	(0.100)***	−0.260	(0.086)***	0.336	(0.099)***	0.493	(0.094)***	0.532	(0.107)***
BA: Age (log.)	−0.565	(0.467)	−0.903	(0.504)*	−2.032	(0.576)***	1.874	(0.513)***	−0.376	(0.495)	−0.952	(0.489)*	−0.852	(0.595)
BA: Residence US	0.867	(0.465)*	0.590	(0.527)	1.020	(0.622)	−0.796	(0.485)	0.891	(0.523)*	0.741	(0.509)	1.641	(0.694)**
Male	0.010	(0.592)	−0.347	(0.556)	−0.076	(0.631)	0.577	(0.439)	−0.316	(0.590)	−0.116	(0.554)	0.162	(0.609)
Education: Business	−0.026	(0.209)	−0.069	(0.223)	−0.259	(0.241)	0.127	(0.226)	−0.257	(0.220)	0.074	(0.216)	−0.076	(0.251)
Education: Tec/Sci	0.291	(0.210)	0.414	(0.223)*	0.296	(0.241)	−0.268	(0.237)	0.224	(0.219)	0.430	(0.213)**	0.078	(0.252)
Education: PhD	0.254	(0.319)	0.448	(0.331)	0.224	(0.355)	−0.853	(0.311)***	0.020	(0.338)	0.453	(0.327)	0.389	(0.369)
CV: Twitter level														
Tweets (log.)	0.206	(0.110)*	0.175	(0.116)	0.325	(0.122)***	−0.031	(0.115)	0.179	(0.106)*	0.227	(0.116)*	0.231	(0.134)*
Followers (log.)	−0.177	(0.087)**	−0.134	(0.089)	−0.183	(0.093)**	0.125	(0.079)	−0.207	(0.085)**	−0.155	(0.093)*	−0.127	(0.105)
Follows (log.)	−0.036	(0.081)	−0.025	(0.085)	−0.053	(0.091)	−0.036	(0.091)	0.008	(0.088)	−0.037	(0.082)	−0.140	(0.092)
IV: Big Five														
Openness	0.090	(0.108)	0.007	(0.116)	0.020	(0.122)	0.015	(0.133)	0.039	(0.111)	0.060	(0.113)	0.081	(0.142)
Extraversion	0.367	(0.105)***	0.277	(0.111)**	0.268	(0.116)**	−0.032	(0.138)	0.268	(0.113)**	0.346	(0.108)***	0.341	(0.128)***
	−0.272	(0.099)***	−0.369	(0.105)***	−0.394	(0.115)***	0.122	(0.109)	−0.248	(0.106)**	−0.325	(0.099)***	−0.403	(0.123)***
Conscientiousness														
Agreeableness	−0.099	(0.069)	−0.071	(0.072)	−0.031	(0.076)	0.045	(0.080)	−0.048	(0.073)	−0.094	(0.071)	−0.098	(0.082)
Neuroticism	−0.073	(0.057)	−0.054	(0.061)	−0.080	(0.066)	0.069	(0.063)	−0.066	(0.061)	−0.056	(0.058)	−0.141	(0.071)**
Hofstede: Culture (4)	Yes		Yes		Yes		Yes		Yes		Yes		Yes	
Ethnicity dummies (5)	Yes		Yes		Yes		Yes		Yes		Yes		Yes	
Year dummies (8)	Yes		Yes		Yes		Yes		Yes		Yes		Yes	
Industry dummies (21)	Yes		Yes		Yes		Yes		Yes		Yes		Yes	
Observations (clusters)	3,234	(1,348)					1,118	(635)	3,234	(1,348)				
Pseudo-R^2	0.139						0.330		0.192					
Log Likelihood	−3,260.123						−371.669		−2,259.289					
Chi^2 (sig.)	13,679.859	***					298.405	***	2,772.930	***				

sonality does not seem to play a major role here and reveal only a weak negative effect of neuroticism on business angel exit (Table 6, Model 3).

As a final proxy for venture success, we consider whether the venture is still active as of January 2018 (=1) or closed (=0). This variable captures *venture survival*. Information is again obtained from Crunchbase. In line with the other proxies above, the results do not show a significant connection between personality and *venture survival* (Table 6, Model 4).

One may argue that syndication mediates the effects of the Big Five on venture success. To test this idea, we estimated two additional models for each dependent variable. One model includes the Big Five; the other one the syndication dummy. The results are shown in Table A5 in the Appendix. While syndication has an effect on some measures of venture success, the results indicate that there seems to be no consistent and meaningful relationship between the Big Five and venture success. Also, the effect of the Big

Table 6
Analyses on venture success and business angel exit.
This table shows multiple analyses that explore the relation between personality and investment success. We use different proxies to measure investment success. Model 1 shows the results of a logic regression with the existence of a follow-up round of financing as the dependent variable. Model 2 shows the results of a logistic regression, where the dependent variable captures whether the venture was acquired via a trade sale or went public via an IPO. Model 3 shows the results of a logistic regression, where the dependent variable captures whether the business angel eventually exited from the venture. Model 4 shows the results of a logistic regression with venture survival as the dependent variable. All variables are defined in Table 1. Coefficients are reported with robust standard errors clustered by business angels in parentheses. Significance levels are denoted by asterisks, *** 1%, ** 5%, and * 10% (p -values are two-tailed).

Dependent variable	Model 1 Follow-up round exists		Model 2 Successful venture exit		Model 3 Business angel exit		Model 4 Venture survival	
Variables	*Logit*	*(SE)*	*Logit*	*SE*	*Logit*	*SE*	*Logit*	*SE*
Syndication (dummy)	2.502	(0.214)***	0.479	(0.233)**	0.195	(0.234)	0.023	(0.325)
CV: Venture level								
Amount raised (log.)	0.294	(0.059)***	0.238	(0.049)***	0.224	(0.049)***	−0.075	(0.070)
Venture: Age (log.)	−0.181	(0.270)	0.347	(0.215)	−0.109	(0.218)	1.047	(0.314)***
Venture: No. of employees	0.385	(0.085)***	−0.085	(0.041)**	−0.077	(0.039)**	0.638	(0.107)***
Venture: No. of founders	0.178	(0.074)**	0.220	(0.044)***	0.210	(0.042)***	−0.084	(0.062)
Venture: Location US	0.535	(0.302)*	0.744	(0.311)**	0.589	(0.315)*	−1.616	(0.683)**
Venture: Location EU	0.420	(0.528)	0.691	(0.398)*	0.509	(0.410)	0.961	(1.305)
Round: Seed-stage	0.114	(0.159)	0.054	(0.107)	0.233	(0.107)**	−0.306	(0.168)*
CV: Investor level								
Previous inv. (log.)	−0.083	(0.053)	0.020	(0.035)	0.017	(0.038)	−0.076	(0.071)
BA: Age (log.)	−0.684	(0.367)*	−0.287	(0.238)	−0.506	(0.246)**	1.121	(0.406)***
BA: Residence US	0.255	(0.344)	0.749	(0.364)**	0.746	(0.319)**	1.253	(0.399)***
Male	0.165	(0.294)	−0.097	(0.185)	−0.208	(0.182)	−0.193	(0.427)
Education: Business	0.183	(0.149)	0.077	(0.098)	0.030	(0.099)	−0.028	(0.150)
Education: Tec/Sci	0.243	(0.157)	−0.048	(0.105)	−0.036	(0.107)	−0.144	(0.176)
Education: PhD	0.013	(0.198)	0.102	(0.118)	0.075	(0.115)	0.071	(0.198)
CV: Twitter level								
Tweets (log.)	0.044	(0.063)	0.022	(0.040)	0.014	(0.042)	−0.031	(0.075)
Followers (log.)	0.009	(0.044)	0.035	(0.028)	0.037	(0.029)	−0.011	(0.056)
Follows (log.)	0.044	(0.058)	−0.063	(0.040)	−0.072	(0.041)*	0.058	(0.065)
IV: Big Five								
Openness	0.030	(0.075)	−0.021	(0.052)	−0.006	(0.052)	−0.067	(0.076)
Extraversion	0.009	(0.068)	−0.044	(0.051)	−0.064	(0.050)	−0.004	(0.084)
Conscientiousness	−0.073	(0.077)	−0.005	(0.049)	−0.052	(0.052)	−0.047	(0.072)
Agreeableness	0.011	(0.042)	0.011	(0.028)	0.000	(0.029)	0.035	(0.047)
Neuroticism	−0.056	(0.039)	−0.028	(0.028)	−0.055	(0.029)*	0.050	(0.048)
Hofstede: Culture (4)	Yes		Yes		Yes		Yes	
Ethnicity dummies (5)	Yes		Yes		Yes		Yes	
Year dummies (8)	Yes		Yes		Yes		Yes	
Industry dummies (21)	Yes		Yes		Yes		Yes	
Observations (clusters)	3234	1,348	3146	1,323	3137	1,320	3082	1,305
Pseudo-R^2	0.196		0.136		0.121		0.177	
Log Likelihood	−825.247		−1633.077		−1597.685		−709.871	
Chi^2 (sig.)	382.180	***	449.497	***	388.667	***	304.726	***

Five on venture success does not seem to be mediated by syndication.

In a nutshell, the relationship between business angel personality and venture success seems to be complex and not as straightforward as the relationship between business angel personality and syndication. Some personality traits could have both a positive and a negative effect on venture success. In aggregate, these effects could then cancel out each other. For example, a business angel high in conscientiousness can be an important resource for the venture team to organize and structure its business model; yet, at the same time, this same business angel might slow down the flexibility of the start-up to adapt to changing market environments and business conditions. The effect of business angel personality on venture success seems to be highly context-specific.

8. Conclusion

The syndication decision of VC firms has been assessed frequently and has been explained from financial, networking, and resource-based perspectives. Syndication is equally or even more important to business angels, who differ from VC firms. We show that considering the personality traits of business angels significantly contributes to explaining their decision to syndicate their investments. Measuring personality through a novel, comprehensive language analysis based on digital footprints in Twitter statements (Boyd and Pennebaker, 2017; Obschonka and Fisch, 2018), we show that business angels with high values of extraversion are more likely to engage in syndication, whereas high values of conscientiousness reduce the likelihood of syndication. In other words, by analyzing public Tweets of business angels, we can predict a particular aspect of their investment decisions that is characteristic of their personality. Hence, such digital footprints might reveal private information of personal patterns in investment behavior.

Our study also has some limitations. For example, we cannot completely rule out a potential selection bias with regard to the business angels included in our sample, even though we used a broad sample. It might be the case that only business angels with a specific personality profile have a Twitter account, which would bias our results. Additionally, we cannot fully rule out reverse causality because we do not have longitudinal data available that would allow us to use panel estimations.

Our study opens several avenues for future research. While syndication is an important and very widespread aspect of new venture finance, an equally interesting aspect would be the interplay between the investor's personality and the eventual success of the investment. While our further analyses indicate that a relationship between the Big Five personality characteristics of the business angel and venture success seems to be absent, a more fine-grained

analysis of how and when business angel personality relates to venture success may be warranted. For example, it would be interesting to assess whether overconfident business angels are more likely to invest in ventures that will eventually fail than business angels who are less overconfident. Another interesting question is whether our findings can be extended to the general population of VC firms. While being institutional investors, investment decisions in VC firms are also often carried out by individuals. It is thus likely that the personality of their investment managers also has an impact on their investment decision. Additionally and relatedly, the impact of the investor's personality might go beyond the decision to syndicate and could potentially affect the target selection or investment sum. Finally, recent research has investigated the role of incubators or technology parks in the context of entrepreneurial ventures (e.g., Cumming et al., 2017). It would be very interesting to investigate the role of personality as regards to how business angels evaluate ventures developed in such incubators. Unfortunately, we could not retrieve this information for the ventures in our sample.

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Conflicts of interest

None.

Appendix

Table A1
Sensitivity analyses using different estimation techniques and making changes to the sample.
This table shows several sensitivity analyses using syndication (dummy) as the dependent variable. Model 1 shows the results of a penalized likelihood estimation using the Firth method to account for a potential bias by rare events. Model 2 shows the results of a logit regression based on a subsample that only includes more work-related Tweets. We identified these Tweets based on another Reciptiviti dimension ("leisure orientation"). We performed a median split and categorized those investors as more work-related, which showed scores below the median in the dimension leisure orientation. Model 3 shows the results of a logit regression based on a subsample in which celebrities with more than 500,000 Twitter followers are excluded. Model 4 shows the results of a logit regression based on a subsample of firms in the seed-stage. Model 5 shows the results of a logit regression with personality variables aggregated on the syndicate level. Model 1 does not include clustered standard errors because the estimation method does not allow for clustering. In Model 5, standard errors are clustered at the syndicate level, while Models 2, 3, and 4 include clustered standard errors at the business angel level. All variables are defined in Table 1. Significance levels are denoted by asterisks, *** 1%, ** 5%, and * 10% (p-values are based on two-tailed tests).

	Model 1		Model 2		Model 3		Model 4		Model 5	
Variables	*Logit*	*(SE)*	*Logit*	*SE*	*Logit*	*SE*	*Logit*	*SE*	*Logit*	*SE*
CV: Venture level										
Amount raised (log.)	0.847	(0.074)***	0.986	(0.113)***	0.898	(0.084)***	1.039	(0.114)***	0.902	(0.085)***
Venture: Age (log.)	0.374	(0.408)	−0.023	(0.519)	0.406	(0.432)	0.097	(0.563)	0.412	(0.427)
Venture: No. of employees	0.007	(0.080)	−0.055	(0.105)	−0.007	(0.089)	0.039	(0.147)	0.006	(0.088)
Venture: No. of founders	0.408	(0.099)***	0.328	(0.143)**	0.448	(0.144)***	0.671	(0.212)***	0.429	(0.142)***
Venture: Location US	0.413	(0.431)	0.279	(0.686)	0.329	(0.539)	−0.183	(0.758)	0.345	(0.510)
Venture: Location EU	0.117	(0.567)	−0.160	(0.783)	0.097	(0.635)	−0.703	(0.864)	0.074	(0.647)
Round: Seed-stage	0.430	(0.201)**	0.227	(0.303)	0.403	(0.206)**			0.457	(0.215)**
CV: Investor level										
Previous inv. (log.)	0.434	(0.098)***	0.304	(0.114)***	0.424	(0.106)***	0.630	(0.142)***	0.457	(0.101)***
BA: Age (log.)	−0.808	(0.473)*	−1.604	(0.727)**	−0.601	(0.482)	−0.557	(0.570)	−0.871	(0.458)*
BA: Residence US	0.819	(0.458)*	0.308	(0.756)	0.888	(0.470)*	1.225	(0.546)**	0.898	(0.508)*
Male	−0.040	(0.497)	0.009	(0.579)	−0.059	(0.661)	0.286	(0.736)	−0.159	(0.532)
Education: Business	−0.069	(0.197)	0.215	(0.310)	−0.001	(0.216)	−0.108	(0.274)	−0.077	(0.202)
Education: Tec/Sci	0.313	(0.206)	0.464	(0.307)	0.288	(0.218)	0.417	(0.284)	0.316	(0.202)
Education: PhD	0.292	(0.307)	0.818	(0.473)*	0.166	(0.330)	0.744	(0.496)	0.300	(0.317)
CV: Twitter level										
Tweets (log.)	0.537	(0.079)**	0.380	(0.142)***	0.080	(0.092)	0.192	(0.126)	0.185	(0.084)**
Followers (log.)	−0.153	(0.056)***	−0.155	(0.098)	−0.055	(0.089)	−0.147	(0.111)	−0.157	(0.062)**
Follows (log.)	−0.034	(0.078)	−0.157	(0.130)	−0.007	(0.084)	−0.054	(0.110)	−0.030	(0.077)
IV: Big Five										
Openness	−0.053	(0.107)	0.054	(0.173)	−0.002	(0.104)	−0.086	(0.145)		
Extraversion	0.315	(0.097)***	0.290	(0.164)*	0.289	(0.104)***	0.471	(0.151)***		
Conscientiousness	−0.294	(0.095)***	−0.295	(0.162)*	−0.322	(0.103)***	−0.205	(0.134)		
Agreeableness	−0.077	(0.066)	−0.176	(0.110)	−0.112	(0.073)	−0.157	(0.099)		
Neuroticism	−0.065	(0.053)	−0.122	(0.095)	−0.038	(0.058)	−0.080	(0.073)		
IV: Big Five (mean per synd.)										
Openness (mean per synd.)									0.072	(0.155)
Extraversion (mean per synd.)									0.461	(0.137)***
Conscientiousness (mean per synd.)									−0.445	(0.127)***
Agreeableness (mean per synd.)									−0.137	(0.108)
Neuroticism (mean per synd.)									−0.083	(0.077)
Hofstede: Culture (4 variables)	Yes		Yes		Yes		Yes		Yes	
Ethnicity dummies (5 variables)	Yes		Yes		Yes		Yes		Yes	
Year dummies (8 variables)	Yes		Yes		Yes		Yes		Yes	
Industry dummies (21 variables)	Yes		Yes		Yes		Yes		Yes	
Observations (clusters)	3,234	(–)	1647	(641)	3036	(1,296)	1967	(998)	3234	(1,744)
Pseudo-R^2	–		0.320		0.293		0.365		0.295	
Log Likelihood	−369.080		−233.443		−422.578		−253.004		−451.416	
Chi^2 (sig.)	245.850	***	346.093	***	307.703	***	239.802	***	278.389	***

Table A2
Sensitivity analyses to account for a potential endogeneity bias.
This table reports the results of an analysis to address the issue of a potential endogeneity bias so (i.e., the Tweets in our sample might be influenced by previous syndication). We therefore collected data for each individual and divided the Tweets according to whether they took place before or after syndication. Each model presented uses the respective Big Five dimension with values achieved after syndication as the dependent variable. The independent variables are generated based on Tweets before syndication. The main independent variable in this model is the syndication dummy. An insignificant dummy indicates that syndication does not significantly influence the after scores, even when controlling for the before scores. The models display the results of an OLS regression. Because before and after information is not available for every individual, the sample is reduced to 829 investments by 572 business angels. All variables are defined in Table 1. Coefficient are reported with robust standard errors clustered by business angels in parentheses. Significance levels are denoted by asterisks, *** 1%, ** 5%, and * 10% (p -values are two-tailed).

Dependent variable	Model 1 Openness (after synd.)		Model 2 Extraversion (after synd.)		Model 3 Conscientiousness (after synd.)		Model 4 Agreeableness (after synd.)		Model 5 Neuroticism (after synd.)	
Variables	*Logit*	*(SE)*	*Logit*	*SE*	*Logit*	*SE*	*Logit*	*SE*	*Logit*	*SE*
Syndication (dummy)	0.067	(0.074)	−0.000	(0.050)	−0.107	(0.118)	0.248	(0.146)*	−0.080	(0.058)
CV: Venture level										
Amount raised (log.)	−0.002	(0.011)	−0.005	(0.012)	−0.013	(0.018)	−0.028	(0.030)	0.008	(0.012)
Venture: Age (log.)	0.034	(0.040)	0.038	(0.048)	−0.107	(0.069)	0.052	(0.092)	0.024	(0.040)
Venture: No. of employees	−0.006	(0.010)	0.003	(0.011)	0.041	(0.016)**	−0.051	(0.026)*	0.001	(0.010)
Venture: No. of founders	−0.003	(0.011)	−0.014	(0.012)	0.007	(0.018)	0.006	(0.027)	−0.011	(0.011)
Venture: Location US	−0.147	(0.058)**	−0.047	(0.051)	0.138	(0.100)	0.046	(0.118)	0.012	(0.064)
Venture: Location EU	0.005	(0.107)	−0.026	(0.080)	0.052	(0.188)	0.380	(0.237)	−0.116	(0.098)
Round: Seed-stage	−0.015	(0.026)	0.024	(0.026)	−0.007	(0.043)	−0.008	(0.062)	0.011	(0.027)
CV: Investor level										
Previous inv. (log.)	0.007	(0.023)	−0.037	(0.026)	0.021	(0.036)	−0.100	(0.070)	0.013	(0.024)
BA: Age (log.)	0.073	(0.078)	−0.147	(0.090)	0.127	(0.129)	−0.188	(0.236)	0.046	(0.086)
BA: Residence US	0.053	(0.074)	0.049	(0.080)	−0.200	(0.121)*	0.257	(0.291)	0.014	(0.073)
Male	−0.169	(0.058)***	−0.194	(0.057)***	−0.030	(0.098)	−0.406	(0.154)***	0.082	(0.073)
Education: Business	−0.076	(0.031)**	0.040	(0.035)	0.156	(0.051)***	−0.209	(0.086)**	−0.005	(0.032)
Education: Tec/Sci	−0.029	(0.029)	0.048	(0.032)	0.069	(0.052)	0.199	(0.082)**	−0.085	(0.031)***
Education: PhD	0.020	(0.037)	0.025	(0.054)	0.001	(0.090)	−0.049	(0.105)	0.043	(0.052)
CV: Twitter level										
Tweets (log.)	0.040	(0.017)**	−0.061	(0.017)***	−0.081	(0.028)***	−0.023	(0.042)	−0.004	(0.018)
Followers (log.)	−0.014	(0.012)	0.023	(0.013)*	0.021	(0.015)	0.017	(0.035)	−0.005	(0.012)
Follows (log.)	−0.011	(0.015)	0.029	(0.015)**	0.049	(0.026)*	−0.021	(0.035)	0.013	(0.016)
IV: Big Five										
Openness (before synd.)	0.443	(0.056)***	0.068	(0.058)	0.047	(0.083)	−0.232	(0.151)	−0.042	(0.060)
Extraversion (before synd.)	−0.018	(0.036)	0.412	(0.045)***	0.154	(0.076)**	−0.096	(0.121)	0.039	(0.042)
Conscientiousness (before synd.)	−0.065	(0.034)*	0.052	(0.037)	0.434	(0.066)***	−0.197	(0.094)**	−0.061	(0.036)*
Agreeableness (before synd.)	−0.018	(0.021)	0.041	(0.021)*	−0.070	(0.038)*	0.508	(0.068)***	−0.017	(0.021)
Neuroticism (before synd.)	−0.005	(0.052)	0.046	(0.053)	−0.252	(0.095)***	0.026	(0.133)	0.454	(0.057)***
Hofstede: Culture (4)	Yes		Yes		Yes		Yes		Yes	
Ethnicity dummies (5)	Yes		Yes		Yes		Yes		Yes	
Year dummies (8)	Yes		Yes		Yes		Yes		Yes	
Industry dummies (21)	Yes		Yes		Yes		Yes		Yes	
Observations (clusters)	829	(572)	829	(572)	829	(572)	829	(572)	829	(572)
R^2 (sig.)	0.372	***	0.396	***	0.482	***	0.501	***	0.385	***

Table A3
Exploring differences across countries and states in more detail.
This table reports the results of an analysis to address differences that arise from a different origin. Model 1 displays a reassessment of the main analysis that additionally includes country dummies to account for any differences in syndication behavior across countries. Model 2 displays a subsample analysis that only considers BA's located in the US. Model 3 further controls for the location of the investment target within the US and only includes targets that are located in the US. The reference category for the venture's location dummies is "Venture: Location rest of the US". All variables are defined in Table 1. Coefficient are reported with robust standard errors clustered by business angels in parentheses. Significance levels are denoted by asterisks, *** 1%, ** 5%, and * 10% (p -values are two-tailed).

	Model 1		Model 2		Model 3	
Variables	*Logit*	*(SE)*	*Logit*	*SE*	*Logit*	*SE*
CV: Venture level						
Amount raised (log.)	0.912	(0.081)***	0.929	(0.086)***	0.898	(0.087)***
Venture: Age (log.)	0.403	(0.395)	0.312	(0.452)	0.569	(0.432)
Venture: No. of employees	−0.008	(0.085)	−0.042	(0.087)	−0.063	(0.090)
Venture: No. of founders	0.416	(0.141)***	0.388	(0.142)***	0.333	(0.139)**
Venture: Location US	0.693	(0.495)	0.611	(0.586)	–	
Venture: Location EU	0.152	(0.615)	0.004	(0.763)	–	
Round: Seed-stage	0.474	(0.202)**	0.506	(0.212)**	0.442	(0.212)**
Venture: Location San Francisco	–		–		1.078	(0.234)***
Venture: Location New York	–		–		0.569	(0.288)**
CV: Investor level						
Previous inv. (log.)	0.463	(0.089)***	0.463	(0.093)***	0.410	(0.103)***
BA: Age (log.)	−1.060	(0.475)**	−1.232	(0.516)**	−0.934	(0.497)*
BA: Residence US	–		–		0.885	(0.344)***
Male	−0.122	(0.543)	−0.127	(0.567)	−0.267	(0.634)
Education: Business	−0.124	(0.211)	−0.101	(0.227)	−0.062	(0.217)
Education: Tec/Sci	0.291	(0.218)	0.231	(0.231)	0.197	(0.225)
Education: PhD	0.329	(0.331)	0.486	(0.361)	0.354	(0.346)
CV: Twitter level						
Tweets (log.)	0.180	(0.103)*	0.199	(0.102)**	0.225	(0.101)**
Followers (log.)	−0.170	(0.079)**	−0.174	(0.075)**	−0.167	(0.076)**
Follows (log.)	0.004	(0.083)	0.002	(0.084)	−0.045	(0.086)
IV: Big Five						
Openness	0.085	(0.112)	0.095	(0.117)	0.033	(0.108)
Extraversion	0.372	(0.103)***	0.335	(0.108)***	0.300	(0.109)***
Conscientiousness	−0.338	(0.103)***	−0.358	(0.109)***	−0.298	(0.098)***
Agreeableness	−0.106	(0.073)	−0.082	(0.078)	−0.060	(0.076)
Neuroticism	−0.095	(0.057)*	−0.103	(0.059)*	−0.087	(0.061)
Hofstede: Culture (4)	No		No		No	
Ethnicity dummies (5)	Yes		Yes		Yes	
Year dummies (8)	Yes		Yes		Yes	
Industry dummies (21)	Yes		Yes		Yes	
Country dummies (9)	Yes		No		No	
Observations (clusters)	3,153	(1,299)	2,992	(1,227)	2,927	(1,303)
Pseudo-R^2	0.265		0.294		0.306	
Log Likelihood	−450.107		−394.635		−398.666	
Chi^2 (sig.)	346.436	***	292.836	***	305.874	***

Table A4
Exploring differences in syndicate size further.
This table shows the results of a generalized ordered logit model. The comparison group are investments with a syndicate size of more than 10. All variables are defined in Table 1. Coefficients are reported with robust standard errors clustered by business angels in parentheses. Significance levels are denoted by asterisks, *** 1%, ** 5%, and * 10% (p -values are two-tailed).

Dependent variable	Model 1 Syndicate size: 0		Syndicate size: 2–5		Syndicate size: 6–10	
Variables	*Logit*	*(SE)*	*Logit*	*SE*	*Logit*	*SE*
CV: Venture level						
Amount raised (log.)	0.838	(0.078)***	0.492	(0.038)***	0.724	(0.071)***
Venture: Age (log.)	0.282	(0.417)	0.123	(0.148)	−0.937	(0.210)***
Venture: No. of employees	0.033	(0.087)	−0.021	(0.033)	0.028	(0.041)
Venture: No. of founders	0.436	(0.135)***	0.047	(0.036)	−0.093	(0.052)*
Venture: Location US	0.351	(0.488)	0.673	(0.213)***	−0.599	(0.301)**
Venture: Location EU	0.034	(0.608)	−0.207	(0.343)	−16.109	(0.468)***
Round: Seed-stage	0.523	(0.200)***	0.505	(0.092)***	0.219	(0.125)*
CV: Investor level						
Previous inv. (log.)	0.515	(0.093)***	−0.079	(0.033)**	−0.078	(0.045)*
BA: Age (log.)	−0.862	(0.489)*	−0.702	(0.241)***	−1.286	(0.309)***
BA: Residence US	0.921	(0.491)*	−0.141	(0.260)	0.125	(0.382)
Male	−0.124	(0.559)	−0.302	(0.176)*	0.035	(0.235)
Education: Business	−0.096	(0.207)	−0.090	(0.089)	−0.224	(0.111)**
Education: Tec/Sci	0.384	(0.208)*	0.098	(0.098)	0.068	(0.120)
Education: PhD	0.127	(0.326)	0.157	(0.127)	−0.019	(0.144)
CV: Twitter level						
Tweets (log.)	0.204	(0.114)*	0.022	(0.040)	0.117	(0.052)**
Followers (log.)	−0.167	(0.088)*	0.019	(0.030)	−0.001	(0.032)
Follows (log.)	−0.043	(0.080)	−0.005	(0.033)	0.007	(0.046)
IV: Big Five						
Openness	0.147	(0.117)	−0.073	(0.049)	−0.015	(0.056)
Extraversion	0.323	(0.106)***	−0.077	(0.049)	−0.040	(0.056)
Conscientiousness	−0.357	(0.099)***	−0.135	(0.046)***	−0.087	(0.061)
Agreeableness	−0.062	(0.065)	0.041	(0.028)	0.044	(0.033)
Neuroticism	−0.067	(0.055)	0.004	(0.027)	−0.027	(0.034)
Hofstede: Culture (4)	Yes		Yes		Yes	
Ethnicity dummies (5)	Yes		Yes		Yes	
Year dummies (8)	Yes		Yes		Yes	
Industry dummies (21)	Yes		Yes		Yes	
Observations (clusters)	3,234	(1,348)				
Pseudo-R^2	0.140					
Log Likelihood	−3,255.488					
Chi^2 (sig.)	9,226.415	***				

Table A5
Further analyses on venture success and business angel exit.
This table shows multiple analyses that explore the relation between personality and investment success while paying specific attention to a potential mediation by syndicate (dummy). We use different proxies to measure investment success. Model 1 and 2 show the results of a logic regression with the existence of a follow-up round of financing as the dependent variable. Model 3 and 4 shows the results of a logistic regression, where the dependent variable captures whether the venture was acquired via a trade sale or went public via an IPO. Model 5 and 6 shows the results of a logistic regression, where the dependent variable captures whether the business angel eventually exited from the venture. Model 7 and 8 shows the results of a logistic regression with venture survival as the dependent variable. All variables are defined in Table 1. Coefficients are reported with robust standard errors clustered by business angels in parentheses. Significance levels are denoted by asterisks, *** 1%, ** 5%, and * 10% (p -values are two-tailed).

Dependent variable	Model 1 Follow-up round exists		Model 2		Model 3 Successful venture exit		Model 4		Model 5 Business angel exit		Model 6		Model 7 Venture survival		Model 8	
Variables	*Logit*	*(SE)*	*Logit*	*(SE)*	*Logit*	*SE*	*Logit*	*SE*	*Logit*	*(SE)*	*Logit*	*(SE)*	*Logit*	*(SE)*	*Logit*	*SE*
Syndication (dummy)			2.495	(0.203)***			0.208	(0.234)			0.041	(0.319)			0.481	(0.233)**
CV: Venture level																
Amount raised (log.)	0.457	(0.056)***	0.267	(0.062)***	0.233	(0.048)***	0.222	(0.049)***	−0.074	(0.067)	−0.079	(0.069)	0.259	(0.048)***	0.236	(0.049)***
Venture: Age (log.)	−0.291	(0.260)	−0.414	(0.267)	−0.109	(0.218)	−0.112	(0.218)	1.047	(0.315)***	1.031	(0.311)***	0.347	(0.216)	0.348	(0.214)
Venture: No. of employees	0.311	(0.077)***	0.353	(0.081)***	−0.078	(0.039)**	−0.078	(0.039)**	0.638	(0.107)***	0.638	(0.107)***	−0.086	(0.041)**	−0.084	(0.041)**
Venture: No. of founders	0.196	(0.073)***	0.114	(0.070)	0.212	(0.042)***	0.211	(0.042)***	−0.083	(0.061)	−0.084	(0.062)	0.224	(0.044)***	0.221	(0.044)***
Venture: Location US	0.425	(0.309)	0.455	(0.311)	0.589	(0.315)*	0.589	(0.319)*	−1.616	(0.682)**	−1.590	(0.696)**	0.738	(0.310)**	0.745	(0.313)**
Venture: Location EU	−0.170	(0.409)	−0.120	(0.454)	0.509	(0.408)	0.510	(0.413)	0.962	(1.304)	1.020	(1.334)	0.683	(0.395)*	0.691	(0.399)*
Round: Seed-stage	0.355	(0.146)**	0.278	(0.152)*	0.237	(0.107)**	0.232	(0.108)**	−0.305	(0.167)*	−0.303	(0.167)*	0.065	(0.107)	0.053	(0.108)
CV: Investor level																
Previous inv. (log.)	0.070	(0.059)	−0.014	(0.063)	0.019	(0.038)	0.010	(0.038)	−0.075	(0.071)	−0.080	(0.067)	0.024	(0.035)	0.015	(0.034)
BA: Age (log.)	−0.927	(0.312)***	−1.039	(0.326)***	−0.507	(0.246)**	−0.503	(0.246)**	1.121	(0.406)***	1.003	(0.400)**	−0.294	(0.238)	−0.266	(0.236)
BA: Residence US	0.270	(0.327)	0.073	(0.326)	0.748	(0.320)**	0.795	(0.321)**	1.254	(0.399)***	1.269	(0.395)***	0.748	(0.364)**	0.777	(0.367)**
Male	−0.210	(0.270)	−0.314	(0.249)	−0.210	(0.182)	−0.187	(0.176)	−0.194	(0.427)	−0.286	(0.433)	−0.099	(0.188)	−0.087	(0.183)
Education: Business	0.111	(0.143)	0.167	(0.143)	0.029	(0.099)	0.018	(0.098)	−0.028	(0.150)	−0.002	(0.148)	0.076	(0.097)	0.078	(0.096)
Education: Tec/Sci	0.108	(0.148)	0.072	(0.151)	−0.033	(0.107)	−0.006	(0.106)	−0.144	(0.175)	−0.133	(0.168)	−0.043	(0.105)	−0.038	(0.105)
Education: PhD	−0.086	(0.184)	−0.138	(0.193)	0.076	(0.115)	0.059	(0.114)	0.071	(0.198)	0.084	(0.195)	0.104	(0.118)	0.096	(0.116)
CV: Twitter level																
Tweets (log.)	0.044	(0.060)	−0.015	(0.061)	0.016	(0.043)	0.022	(0.040)	−0.031	(0.075)	−0.013	(0.069)	0.023	(0.040)	0.016	(0.037)
Followers (log.)	0.031	(0.041)	0.057	(0.044)	0.036	(0.029)	0.030	(0.029)	−0.011	(0.056)	−0.007	(0.057)	0.034	(0.028)	0.033	(0.028)
Follows (log.)	−0.033	(0.060)	−0.003	(0.060)	−0.073	(0.041)*	−0.068	(0.041)*	0.058	(0.065)	0.045	(0.062)	−0.064	(0.040)	−0.058	(0.039)
IV: Big Five																
Openness	−0.070	(0.075)			−0.006	(0.052)			−0.067	(0.076)			−0.021	(0.052)		
Extraversion	0.038	(0.071)			−0.063	(0.050)			−0.004	(0.084)			−0.042	(0.051)		
Conscientiousness	−0.145	(0.078)*			−0.054	(0.052)			−0.048	(0.072)			−0.010	(0.049)		
Agreeableness	0.059	(0.042)			−0.000	(0.029)			0.035	(0.047)			0.010	(0.028)		
Neuroticism	−0.054	(0.043)			−0.056	(0.029)*			0.050	(0.048)			−0.030	(0.028)		
Hofstede: Culture (4)	Yes		Yes		Yes		Yes		Yes		Yes		Yes		Yes	
Ethnicity dummies (5)	Yes		Yes		Yes		Yes		Yes		Yes		Yes		Yes	
Year dummies (8)	Yes		Yes		Yes		Yes		Yes		Yes		Yes		Yes	
Industry dummies (21)	Yes		Yes		Yes		Yes		Yes		Yes		Yes		Yes	
Observations (clusters)	3,234	(1,348)	3,234	(1,348)	3,137	(1,320)	3,137	(1,320)	3,082	(1,305)	3,082	(1,305)	3,146	(1,323)	3,146	(1,323)
Pseudo-R^2	0.121		0.181		0.120		0.119		0.177		0.175		0.135		0.136	
Log Likelihood	−943.900		−880.403		−1,598.055		−1,600.463		−709.873		−711.723		−1,635.135		−1,633.943	
Chi^2 (sig.)	308.799	***	418.624	***	388.574	***	375.861	***	303.412	***	283.822	***	441.979	***	444.372	***

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