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An Ex-Ante Analysis of the Character-Based Approach**

Berlin, March 2007

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IMPRESSUM

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<http://www.diw.de>

ISSN print edition 1433-0210

ISSN electronic edition 1619-4535

Available for free downloading from the DIW Berlin website.

Is Entrepreneurial Success Predictable? An Ex-Ante Analysis of the Character-Based Approach*

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Abstract

This paper empirically analyzes whether the character-based approach, which is based on the personality structure and the human capital of business founders, allows prediction of entrepreneurial success. A unique data set is used consisting of 414 previously unemployed persons whose personal characteristics were screened by different methods, namely a one-day assessment center (AC) and a standardized questionnaire, *before* they launched their business. Results are partly unexpected: first, there is almost no correlation between the AC data and the questionnaire. Second, the predictive power of the AC data is slightly better than that of the questionnaire, but lower than expected in theory. Interestingly, for those subgroups where the AC data have low predictive power, the questionnaire does better. Third, when success is measured in terms of employees hired, the character-based approach is a poor predictor.

Keywords: Entrepreneurship, Psychological Assessment, Character-Based Approach, Success Prediction

JEL Classification: M13, J23, C13

*The authors thank Friedel Bolle, Christoph Kneiding and Ulf Kieschke for helpful comments and Katrin Kahle and Denitsa Vigenina for valuable research assistance in the field and in the data preparation. Moreover, the authors are very grateful to Gunda Laasch-Wrobel, Hajo Streitberger and Thorsten Müller. Without their support, this paper would not have been possible. Last but not least, we would like to thank the 414 entrepreneurs who agreed to become a ‘research subject’ and for their willingness to be interviewed once more, even though entrepreneurs usually have no time to spare. Alexander Kritikos gratefully acknowledges the financial support of the Institute for Labor Market Research (project no. 1-910) and of the Equal framework EXZEPT which is financed by the European Social Funds (ESF) and by the German Ministry of Labour and Social Affairs.

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1 Introduction

Entrepreneurship involves special kinds of decision-making processes. Because of this, it is argued that the success of a business depends on the entrepreneur's personality structure, and that this is true in particular for previously unemployed persons. Failure rates of entrepreneurs are high, and so are the costs incurred thereby: not only does failure mean that entrepreneurs lose their own investments and the income opportunities they could have taken advantage of otherwise; it may also mean that banks as well as 'friends, fools and family' lose the capital they had invested (in terms of loans or equity); that government agencies misallocate tax money to support these entrepreneurs through lump-sum payments (like the bridging allowance in Germany or similar support schemes offered in other countries), free access to seminars, training or coaching or subsidized loans.¹ The decision to become an entrepreneur might open up a great chance to generate income, but it might also mean an inefficient allocation of private and public money, not to speak of the psychological costs of failure for the persons themselves. For these reasons, all stakeholders are interested in the same question: Is entrepreneurial success predictable?

In this context, several psychologists and economists² proposed that the personality of the entrepreneur has a crucial impact on the success of a firm, in particular when the firm is run by one entrepreneur alone or has only a few employees. Psychologists have identified several variables that appear to have a major influence on entrepreneurial success. These variables deal either with the human capital, that is, entrepreneurial knowledge, or with those personality characteristics that are important for developing entrepreneurial skills, such as 'need for achievement', 'locus of control', 'problem-solving orientation', 'interpersonal reactivity' and 'assertiveness'. These personality characteristics together with entrepreneurial knowledge define the character-based approach. As most psychologists further assume that the personality of human beings consists of given traits that are stable over time, it is expected that in particular the personality characteristics fulfill all prerequisites of allowing prediction of future success.³

¹For an overview of support measures in European Countries, see Siewertsen and Evers (2005). Caliendo, Kritikos, and Wiefner (2006) provide an overview of the support schemes in Germany.

²For excellent surveys of the research in psychology, see Rauch and Frese (2000), and in economics, see Bianchi and Henrekson (2005).

³There is an ongoing discussion about whether these variables are indeed a 'given set' of traits determining the development of a person as an entrepreneur or whether these variables are influenced by the working experience of a person as self-employed (see inter alia MacMillan and Katz, 1992). Empirical evidence in favor of the stability hypothesis has been put forward by Brandstätter (1997) and Müller (1999);

The impact of these traits on entrepreneurship has been empirically tested in a number of studies, particularly by making use of psychologically validated questionnaires (see, e.g., King, 1985). So far, ex-post tests have been conducted in two ways: by comparing the traits of successful entrepreneurs with the same traits of either employees or unsuccessful entrepreneurs. Both comparisons showed that there are significant differences between the personalities of successful entrepreneurs and those of the other two groups.

In this paper, we investigate for the first time (to our knowledge) whether it is possible to predict the development of a business ex-ante by applying the character-based approach. Furthermore, also for the first time, we use three independent methods of examining the parameter values of the traits and of the human capital status for every potential entrepreneur. The first is a questionnaire where participants have to answer closed-ended questions; the second is an assessment method where participants carry out specific tasks while psychologists observe their performance; and the third is a presentation of the business idea where information is gathered on the specific current human capital of each entrepreneur in areas relevant to running a business. We have at our disposal a data set from a business incubator in the city of Hamburg where these methods were applied simultaneously to screen individuals *before* they started a business. In Section 2, we describe the assessment methods.

After explaining the screening methods, we will identify the variables assumed to be crucial for entrepreneurial development. Research in particular in psychology but also in economics has focused on those personality traits mentioned earlier in this section as candidate variables. Hence, in Section 3 we will review those variables that can be assumed to have an impact on the success of a potential entrepreneur.

In Section 4 we analyze our unique data set consisting of 414 business-founders who were assessed and then received support from the business incubator in Hamburg. We combine these data with a second, short questionnaire which only asked for actual employment status and the size of the business. On this basis, we are able to make two kinds of analyses: we start by examining the correlations between the different assessment methods before we use an ex-ante test to investigate the extent to which these variables are able to predict the prospective success of a business. Section 5 concludes our findings.

in favor of the socialization hypothesis by Blanchflower and Oswald (1998). While Brandstätter concludes that personality differences may explain differences in entrepreneurial success, the latter authors declare that ‘psychology apparently does not play a key role in determining who becomes an entrepreneur’.

2 Data Source: Business Founders in Hamburg

The source of our data is a ‘business incubator’ located in Hamburg. The main target group of this incubator are formerly unemployed persons who are planning to found, own and manage a new business under their own liability.⁴ The support offered through the program consists of an ‘integrated concept’ covering a period of six months and offering knowledge transfer combined with training and structured feedback on the initial work undertaken by these entrepreneurs.⁵ Persons seeking this kind of support were sent to a one-day assessment center (AC) where they met with two trained psychologists and two laypersons. The purpose of the screening process was to allow the incubator team to collect information about the candidates’ skills and the level of pre-existing knowledge at the point of entry to the program.

In order to evaluate the basic entrepreneurial knowledge and skills of all applicants, the AC uses three independent tools for the evaluation: a standardized questionnaire, a presentation of the business idea by the applicant, and a number of structured exercises where each applicant is assigned to certain roles allowing the psychologists to observe the parameter values of the personality traits mentioned in the introduction.

The questionnaire consists of a paper-and-pencil test which was designed by Müller (1999) based on the initial questionnaire of King (1985). It comprises five items for each trait. The items have a sentence completion format where each applicant is required to choose the one of the three response alternatives that best corresponds to his or her own preferences. For each question, there is only one answer that matches the trait to be tested. The more often the chosen responses correspond to the aptitude associated with the respective trait, the higher the person’s test score. Test scores ranged between 0 and 5, with 0 (5) indicating that none (all) of the chosen alternatives were equal to the trait-specific response alternative. We have access to data for four traits, ‘need for achievement’ (Test 1), ‘locus of control’ (Test 2), ‘problem-solving orientation’ (Test 3) and ‘assertiveness’ (Test 4). Details on these traits will be explained in Section 3.

The second screening method is similar to those used in traditional assessment cen-

⁴The classification of our sample is close to the definition of entrepreneurship used by Hisrich (1990). The only difference is that the persons we observe have not yet started their own business. At the point of observation, they do not know for sure either whether they will indeed start their own business or whether they will work alone or have other employees. For a discussion of the issue of how to correctly define entrepreneurs, see for instance Brandstätter (1997) or Rauch and Frese (2000). Some definitions assert that entrepreneurship only applies to firms having at least one employee in addition to the owner.

⁵For more information on the design of this incubator, see Kritikos and Wiessner (2004).

ters. Here, three exercises were developed. In these exercises, participants were given specific roles and had to solve pre-described problems within groups of four to five persons. While doing so, two psychologists and two laypersons examined the extent to which the candidates exhibited certain personality traits such as ‘problem-solving orientation’, ‘assertiveness’ or ‘need for achievement’. Thus, the observers focused on the behavior of the participants (not on the subject of the discussion). Instead of an indirect self-assessment, this second screening method is a third-party-assessment, where the third party, if neutral and properly trained, translates the observed behavior into scaled parameters of personality traits. In the next section, we will present the variables for which we have data based on the first method, a standardized questionnaire and the ones for which we have data based on the second method, the psychological assessment.

Last but not least, the potential entrepreneurs had to present their business idea at the assessment center. They were informed beforehand that they should provide specific information about their concept, for instance the target group or market that the product is aimed at, and the financial means needed to launch the business. Accordingly, this third screening method, which again was used by the two psychologists, focused on parameter values of entrepreneurial knowledge for each applicant.

Having clarified the method for gathering the variables of interest, we now describe which variables were collected by each of the three screening methods and briefly analyze why exactly these particular variables were chosen.

3 The Character-Based Approach

Theoretical analysis of the key factors of entrepreneurial success has been manifold. As our empirical study concentrates on the predictive power of the character-based approach, which is composed of the personality structure and the human capital of an entrepreneur, we will limit our discussion in this section to the relevant models of entrepreneurial success. It should be underlined that other important models exist as well that also analyze the development of small firms, such as the business-oriented or the environmental approach.⁶

⁶For overviews of the business-oriented approach, see, e.g., Porter (1981), Klandt (1984), Williamson (1985), Picot, Laub, and Schneider (1989), Brüderl, Preisendörfer, and Ziegler (1992). There are various empirical analyses of the business-oriented approach, see inter alia Blanchflower and Oswald (1998) or Evans and Jovanovic (1989) who showed that the amount of available capital is correlated with the success rate of a newly founded business. For some theoretical background and empirical analyses

3.1 Personality Characteristics and Entrepreneurship

In particular psychological but also economic research has analyzed in detail which personality characteristics are fundamental for entrepreneurial success. The following traits have been defined as useful in explaining the past success and in predicting the future development of a newly founded business: motivational traits, such as ‘need for achievement’, ‘internal locus of control’, and ‘need for autonomy’, cognitive skills such as ‘problem-solving orientation’, ‘tolerance of ambiguity’, ‘creativity’ and ‘risk-taking propensity’, affective personality traits, such as ‘stress resistance’, ‘emotional stability’, and ‘level of arousal’, and social skills, such as ‘interpersonal reactivity’ and ‘assertiveness’.⁷ Empirical research aiming to underpin the theoretical propositions ex-post has taken two directions: it has compared the parameter values of these variables, gathered with the help of psychologically validated questionnaires, either between entrepreneurs and employees, or between successful and unsuccessful entrepreneurs.

In the following, we will present the five most important variables (of those mentioned above) for which previous research suggested the predictability of entrepreneurial success from a theoretical and an empirical point of view and for which our own data set allows us to make an ex-ante test.

The first (and most often discussed) variable to be analyzed is ‘need for achievement’. It expresses the motivation of business founders to search for new and better solutions than those given in the actual (market) environment, and their ability to realize these solutions through their own performance in the market (see McClelland, 1961; Holmes and Schmitz, 1990; Lumkin and Dess, 1996). If a person is able to achieve such goals, it is said that the achievement motivation of this person corresponds to the prerequisite of becoming a successful entrepreneur. Significant differences with respect to this variable were found between entrepreneurs and managers by Begley and Boyd (1987), Green, David, and Dent (1996) and Müller (1999), and between successful and unsuccessful entrepreneurs by McClelland (1987) and Goebel and Frese (1999). Within the present analysis, the

on the environmental approach, see, e.g., Hannan and Freeman (1977), Brüderl and Schüssler (1990), Sing (1990), Aldrich and Wiedenmayer (1993), Shane and Kolvereid (1995), Dean and Meyer (1996) or Swaminathan (1996).

⁷There has been extensive research on these variables in psychology. For thorough discussions of the impact of these variables on the entrepreneurial success, see, e.g., Rotter (1966), McClelland (1961, 1985, 1987), Wärneryd (1988), Chell, Harworth, and Brearley (1991), Cooper and Gimeno-Gascon (1992), Furnham (1992), Brandstätter (1997), Rauch and Frese (2000), Müller and Gappisch (2005). In economics, Kihlstrom and Laffont (1979) as well as Holmes and Schmitz (1990) have made important contributions relating to the variables of risk-taking propensities, and need for achievement.

variable ‘need for achievement’ will be measured in two ways, by making use of Test 1 of the questionnaire and by the evaluation based on the observations during the AC.

‘Locus of control’ (drawing on a concept of Rotter, 1966, and Furnham, 1986) measures generalized expectations about internal versus external control of reinforcement. People with an internal locus of control believe that they are able to determine their future development through their own actions. Persons with an external locus of control believe that their own behavior does not have any impact on their future outcomes, and that success and failure is determined randomly, or by the external environment. Accordingly, it is assumed that persons with an internal locus of control will be more successful as entrepreneurs than individuals with an external locus of control. Empirical tests by King (1985), Bonnet and Furnham (1991), Rahim (1996) and Müller (1999) found significantly higher rates of locus of control for entrepreneurs than for managers. As to the comparison of successful with unsuccessful entrepreneurs, Goebel and Frese (1999) report significant differences. In the present study, the variable ‘locus of control’ will be assessed by making use of Test 2 of the questionnaire.

‘Problem-solving orientation’ expresses the cognitive ability to act in a complex environment and to feel attracted to non-routine tasks. It enables an individual to understand and solve existing problems by transferring knowledge into specific actions (see also Conrad, Müller, Wagener, and Wilhelm, 1998). Empirical evidence that a high value in ‘problem-solving orientation’ is correlated with entrepreneurship is found by King (1985), Buttner and Gryskiewicz (1993) and Müller (1999). Within the present framework, the variable will be measured by making use of Test 3 of the questionnaire and of the psychological evaluation during the AC.

‘Interpersonal reactivity’ describes the ability to put oneself in the place of another person. In the context of entrepreneurship, it expresses the ability to approach other people and develop rewarding relationships with them (see, e.g., Bierhoff and Müller, 1993). It is believed that a sufficient level of ‘interpersonal reactivity’ enables the entrepreneur to produce more client-oriented products, which is why this variable is related to entrepreneurial success. Empirical evidence on this relation is found by Baron (2000). We will analyze this variable by making use of the categorical variable ‘assertiveness/interpersonal reactivity’ which was extracted from the evaluation during the AC.

The final variable, ‘assertiveness’, expresses the ability to assert oneself and achieve

one's interests in a socially acceptable way. This variable is therefore complementary to the previous one, 'interpersonal reactivity', and relates to the total performance of an entrepreneur towards his clients and suppliers. It is assumed that if the ability to assert oneself is sufficiently (but not excessively) high⁸, the entrepreneur will be better able to achieve planned profits. Also with respect to this variable, empirical studies revealed significant differences between entrepreneurs and managers (cf. King, 1985; Chell, Harworth, and Brearley, 1991; Brandstätter, 1997; Müller, 1999). Within the present framework, the variable 'assertiveness' is analyzed by making use of Test 4 of the questionnaire. Moreover, as psychological research relates the variable 'assertiveness' to 'interpersonal reactivity', both were measured during the psychological evaluation by making use of one categorical variable (which combines assertiveness and interpersonal reactivity).⁹

INSERT TABLE 1 ABOUT HERE

Table 1 displays the traits used in the present analysis, empirical findings from previous studies, and the measurement methods applied. All five variables are expected to have a positive impact on entrepreneurial success.

Psychological research has further clarified (for instance, in the so-called 'Giessen-Amsterdam Model') why these particular variables are so crucial for entrepreneurial success. According to this model, these specific traits are expected to produce a strong impact on planning the business and on the choice of strategies and actions during the launching phase, which will in turn determine the entrepreneur's eventual success in the undertaking.¹⁰ Our overview of the existing empirical analysis showed that there are significant ex-post differences between entrepreneurs and managers and between successful

⁸Winslow and Solomon (1987) described the optimal level of assertiveness as 'mildly sociopathic'.

⁹In this context it should be highlighted that there is (in addition to these five) one further variable, 'risk attitudes', which is deemed crucial for the development of a business (for empirical evidence, see e.g., Hartog, Ferrer-i Carbonell, and Jonker, 2002). Chell, Harworth, and Brearley (1991) as well as Klandt (1996) assert, however, that it would be wrong to expect that risk-seeking entrepreneurs would have a higher success probability. Business founders should always try to reduce their risks as much as possible without becoming too risk-averse. The risk associated with a business opportunity should therefore be of a medium range. Empirical research has also found that risk attitudes have a negative effect on success beyond a certain point (cf. Begley and Boyd, 1987). Moreover, in a recent study it was shown that the decision to become an entrepreneur is positively related to risk attitudes, but only if business founders start out of regular employment (cf. Caliendo, Fossen, and Kritikos, 2006). For founders out of unemployment, risk attitudes seemed to play no role, not even for the decision to become self-employed. In the present study, we have no access to data with respect to this variable.

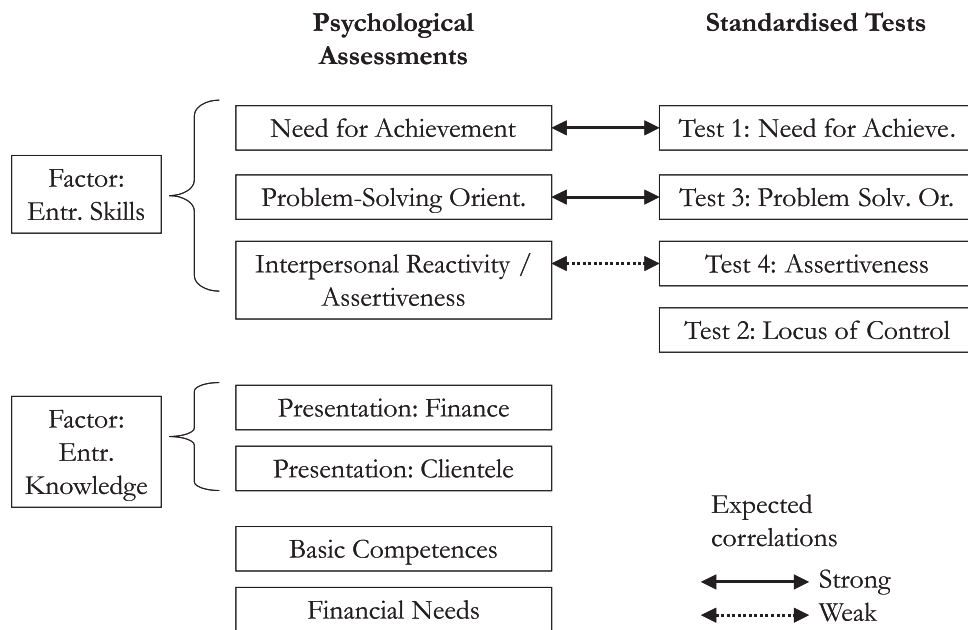
¹⁰Of course, this relationship holds only if the person observed is also the source of the action (for more details on the 'Giessen-Amsterdam Model', cf. Rauch and Frese, 2000).

and unsuccessful entrepreneurs with respect to these variables.¹¹

In the following, we will derive four hypotheses to be tested in the empirical analysis. Based on the theoretical approaches described and the previous empirical findings, we start with *Hypothesis 1*, which tests whether, if properly assessed, entrepreneurs' probability of business success will increase in proportion to the following personal characteristics: 1) 'achievement motivation', 2) internal 'locus of control', 3) 'problem-solving orientation', 4) 'assertiveness', and 5) 'interpersonal reactivity'.

Our next hypothesis concerns the two ways of testing the variables, namely the psychological evaluation and the standardized questionnaire. In the cases where both methods measure parameter values of the same variables, we state in *Hypothesis 2* that there should be significant correlations between the two test methods, as displayed in Figure 1 where the expected correlations are described.

Figure 1: Overview of the Set of Variables and Expected Correlations



Note: The factors entrepreneurial knowledge and entrepreneurial skills will be explained in Section 4.2.

Previous research has also pointed out the limits of this approach. On the one hand, the size of the firm in terms of number of employees has been described as indispensable for the application of the model. According to this argument, the fewer employees a

¹¹There is one study explicitly testing whether other, more general variables also have predictive power: Baum (1995) found that the variables studied here are more strongly related to entrepreneurial success than more general variables (such as those used in the famous 'big five' test.)

business has, the greater the impact of the owner’s personality on its success.

On the other hand, there is no consensus on the impact of personality structure on entrepreneurial success. Müller (1999) suggests that these traits should be used to predict the development of an individual as entrepreneur. Given the numerous personality variables that might influence entrepreneurial success, a second expectation is that each individual variable will only be a weak predictor for entrepreneurial success (cf., e.g., Rauch and Frese, 2000). Gartner (1988) believes that no correlations will be found between traits and the success of an entrepreneur at all because ‘the diversity among entrepreneurs is much larger than differences between entrepreneurs and non-entrepreneurs’.

It has therefore been suggested that correlations between all variables should be tested for, and that factors be extracted (if a corresponding factor analysis allows us to do so), enabling analysis of more general entrepreneurial personality trait dimensions (see, e.g., Robinson, Stimpson, Huefner, and Hunt, 1991; Miner, 2000; Rauch and Frese, 2000; Müller and Gappisch, 2005). Such approaches also relate to the more parsimonious trait typologies used in the economic sciences, for instance by Lucas (1978), who focuses on entrepreneurial talent, or by Holmes and Schmitz (1990), who define entrepreneurial abilities as crucial in distinguishing successful entrepreneurs from employees.

In our paper, we will, therefore, also test to what extent the personality variables are correlated between each other and to what extent it is possible to extract factors from these variables. Under the condition that we are able to do so, we state in *Hypothesis 3* that the higher the factors extracted from the trait variables, the higher the business founder’s probability of entrepreneurial success will be.

3.2 Human Capital and Entrepreneurship

Human capital theories relate to entrepreneurial success in a similar way as personality structure: sufficient knowledge and working experience in the relevant fields enable business founders to choose more efficient approaches, for instance in organizing production processes, creating financial strategies, or analyzing markets for the new product. The human capital of the entrepreneur is the second part of the character-based approach after the entrepreneurial personality.

Most theoretical studies analyzing the impacts of human capital on the success probability of a new venture are concerned with the general human capital (such as the years

of schooling or working experience), with various kinds of specific human capital (such as experience in leadership, in self-employment or in the industry chosen for the new venture), or with genetic or sociological relations (such as self-employed parents or friends). Recent research on the impact of general human capital by Backes-Gellner and Lazear (2003) has shown that it is important for later success if business founders have already developed a broader knowledge base rather than specialized knowledge of a certain topic.

Relationships between the human capital approach and the success rates of entrepreneurs have been empirically tested as well: Chandler and Hanks (1994, 1996) showed that there is a positive impact when entrepreneurs found a new businesses in the same branch where they had gathered previous work experience. The same authors observed only a weak impact of general human capital on success rates in terms of years of schooling. An explanation of the latter is given by Lazear (2004), and by Wagner (2003), who found empirical support for Lazear's 'jack-of-all-trades model' which is not necessarily correlated with years of schooling. Finally, Dunn and Holtz-Eakin (2000) found a positive correlation between success rates of business founders and self-employed parents.

While most previous empirical research on human capital has been concerned with general educational variables, in this paper we are able to analyze whether the specific entrepreneurial knowledge of potential founders has any impact on the later success of their businesses. We have access to four variables which relate to the actual level of specific human capital. As mentioned above, these variables were gathered by the psychologists during the presentation of the business idea. 1) We monitored whether business founders had working experience in the branch of the planned business (basic competencies). 2) From the set of specific human capital variables, we observed whether the business founders had knowledge of i) the financial background they will need to start the business (presentation finance), of ii) the potential clients who should be willing to buy the planned product (presentation clients), and of iii) the further financial needs in subsequent years if the business should develop as planned (financial needs).

With respect to the predictive power of human capital, psychologists argue that variables describing the status quo of a person's entrepreneurial knowledge are subject to change, for instance through training, seminars and coaching. Therefore, *Hypothesis 4* states that the level of human capital observed before starting the business is not correlated with later entrepreneurial success.

4 Empirical Analysis

In the present study, we make use of data on 414 applicants who went through the above-described AC and founded their own firm in the business incubator in Hamburg. The participants launched their businesses between 2001 and the beginning of 2004. In order to assure no heterogeneity regarding support to the individuals, we restrict our analysis to applicants who made use of the same kind of incubator service, which is briefly outlined in Section 2.

In addition to the data from the AC, we collected information on the actual performance of these persons. The aim was to identify how many business founders were still self-employed, how many had since accepted a position as a salaried employee, and how many had become unemployed. Those who had started their own businesses were also asked whether they had any employees. The data for this analysis was gathered through telephone interviews carried out in the first quarter of 2005.

INSERT TABLE 2 ABOUT HERE

Table 2 contains some summary statistics on the variables available, which we will describe in Section 4.1. The first column refers to the whole sample of participants. Since we expect that the economic development of entrepreneurs differs between older and younger as well as between men and women, we analyze these groups separately: columns 2 through 5 differentiate the sample by age and gender. One shortcoming of the data is that we do not know the actual age of the individuals: only whether they are above or below 30 years old. As can be seen in the table, men are over-represented in our sample in the same relation as they are in the total population of entrepreneurs in Germany (see Caliendo, Kritikos, and Wießner, 2006).

After a short overview of the descriptives of the data, we will start our empirical analysis in Section 4.2 with an examination of the standardized test variables and of the assessment conducted by the psychologists. In doing so, we aim to test whether the observed parameter values of the variables in the questionnaire correspond with those of the psychological assessments. In Section 4.3, we test the predictive power of the different variables (tests and assessments) on two distinctive outcome variables: the employment status and number of employed persons in the newly founded business.

4.1 Set of Variables and Some Descriptives

Table 2 provides an overview and some summary statistics on the available information. We will briefly discuss each variable and its distribution in the data. We start with the standardized tests described in Section 3. Four test variables were used, with a scaling from 0 to 5, where 5 indicates the best and 0 the worst result possible. The first variable reflects the applicant's 'achievement motivation', the second his or her degree of possessing an 'internal locus of control', and the third reflects the applicant's 'problem-solving orientation'. The fourth test is a measure of the applicant's 'assertiveness'. It is interesting to note that all tests are fairly equally distributed among the four subgroups. The fourth test is the one where applicants achieve the lowest test scores. The average values and variances of all four test scores (also the one on assertiveness) correspond perfectly to previous empirical findings (see Müller, 1999).

The rest of the variables articulate the evaluation by two psychologists (who were assisted by two laypersons) on different scales while observing the performance of the applicants during the presentation of their business ideas and during the exercises.

The first block of variables analyzed at the AC dealt with the applicant's business-specific human capital. 'Basic competencies' is scaled as 0(=no) or 1(=yes) and 94 percent of the participants in the incubator fulfilled this requirement. 'Presentation: finance' is scaled on a choice set of 1(=no), 2(=partly) and 3(=very well). This variable is equally distributed among the four sub-samples at a value of 2.1. 'Presentation: clientele' is scaled on the same choice set as presentation finance and the average assessment is 1.94. Here, young people scored worse than average (while older people did better). 'Financial needs' is scaled as 0(=no) or 1(=yes), where 41 percent of all applicants had a concept of how to finance their business in the future, with a lower rate for women at 35 percent.

The second block of variables analyzed at the AC dealt with personality traits: the need for achievement, interpersonal reactivity, assertiveness, and problem-solving orientation. 'Need for achievement' and 'problem-solving orientation' were each measured on a scale from 1 (weak) to 3 (strong). The average value was for the former 1.8 and for the latter 1.95 (both intermediate). 'Assertiveness' and 'interpersonal reactivity' were measured by one categorical variable. A value of 1 reflects weak assertiveness and weak interpersonal reactivity (24% of the sample), 2 reflects weak assertiveness and strong interpersonal reactivity (36%), 3 strong assertiveness and weak interpersonal reactivity (27%),

and 4 well-balanced assertiveness and interpersonal reactivity (12%). It is interesting to note that younger people received higher scores on the variable interpersonal reactivity and older persons higher scores on assertiveness.

4.2 Correlation Analysis — Standardized Tests versus Psychological Assessments

Table 3 contains pairwise correlation coefficients of the four standardized tests and the five psychological assessments. To increase the visibility of the results, we only included coefficients that are at least significant at the 10 percent level; a star indicates significance at the 5 percent level.

First of all, the upper part of the table reveals correlations between the variables gathered in the questionnaire. The lower part shows that the variables measuring personal traits and those measuring the entrepreneur-specific human capital were also correlated. We further checked the correlation of the variables for the subgroups discussed before. The results can be found in Tables A.1 (men/women) and A.2 (Age below/above 30 years) in the Appendix and show that the high correlations within the two assessment methods hold true for all subgroups in almost all cases. There is only one exception for women showing that for the questionnaire data tests 1 and 4 are negatively correlated.

We made a factor analysis and extracted a factor labeled ‘entrepreneurial skills’ from the variables ‘achievement motivation’, ‘assertiveness/interpersonal reactivity’, and ‘problem-solving orientation’.¹² We were able, as well, to extract a second factor, ‘entrepreneurial knowledge’, from the variables ‘presentation: clientele’ and ‘presentation: finance’ (see also Figure 1). Since the same holds true for the standardized test, we made use of a cluster analysis to condense the information to a dummy variable dividing the observations into two groups (with high and low overall test scores).

INSERT TABLE 3 ABOUT HERE

Coming to the analysis of *Hypothesis 2*, the expected correlations between the two tests, we found rather surprising results: only the variables ‘problem-solving orientation’ and ‘presentation: finance’ are correlated with the standardized test variables 1, 2 and 3, although on a low level of around 0.09. Thus, as the third test should measure the

¹²Detailed results from the factor analysis are available on request.

individual’s problem-solving orientation, we observe only one correlation with the psychological assessment in the way it was expected in Figure 1. ‘Test 1 and Achievement Motivation’ as well as ‘Test 4 and Assertiveness’ are not correlated.

When analyzing correlations of the variables for the subgroups (see again Tables A.1 (men/women) and A.2 (below/above 30)) we found more mixed results: for individuals older than 30 years, we found the most positive correlations, namely for two combinations ‘Test 1 and Achievement Motivation’ as well as for ‘Test 4 and Assertiveness’. Curiously, for people younger than 30 years the same (and some further) combinations are negatively correlated. The differentiation by gender produces no further insights.

Thus, these observations lead to two conclusions. The high correlations *within* each of the two assessment methods allows us to extract two factors from the assessment center data, and to make a cluster analysis of the test scores based on the questionnaire. Due to the low correlations *between* the two assessment methods there is no support for *Hypothesis 2*.

It seems that standardized tests and psychological assessments measure parameter values that are (in the overall data set) independent of each other, and in some subgroups positively, in others negatively correlated. Recent research points to a possible explanation for diverging results, namely a perception bias: Arenius and Minniti (2005) argue that the self-assessment of entrepreneurial skills might be biased and Köllinger, Minniti, and Schade (2005) offer first evidence that business founders are not immune to overconfidence when making a self-assessment of their entrepreneurial skills. Even if the questionnaire is an indirect self-assessment, the possibility cannot be ruled out that there was a perception bias among the business founders, in particular among the younger ones where we found negative correlations.¹³ We will return to this point in the following section.

4.3 Analyzing the Success of the Start-Ups

We analyze the predictive power of the variables with respect to two distinct outcomes. In a first regression, we check the influence of the variables on the employment status of the individuals as recorded at the time of the interview. To be specific, we estimate a

¹³Table 2 reveals that for the two variables ‘need for achievement’ and ‘assertiveness’, which are negatively correlated among the younger entrepreneurs, the self-assessment in the questionnaire was on average almost the same as for the older subgroup while the AC data showed lower parameter values for the younger entrepreneurs in comparison to the older ones.

multinomial logit model of the form

$$P(y_i^1 = j) = \frac{\exp(x'_{ij}\beta)}{1 + \exp(x'_{i2}\beta) + \dots + \exp(x'_{iM}\beta)}, \quad j = 1, 2, \dots, M, \quad (1)$$

where y^1 can take on the values self-employed ($y^1 = 1$), regular employed ($y^1 = 2$) or unemployed ($y^1 = 3$). X is a vector of explanatory variables which we define further below and the coefficients β are the ones we are interested in.

A further measure that we want to analyze relates to the success of the entrepreneur in terms of employees.¹⁴ Therefore we construct an outcome variable which takes on the value 1 if the self-employed person has at least one employee at the time of the interview and 0 otherwise, i.e.,

$$y_i^2 = \begin{cases} 1 & \text{if Employees} \geq 1 \\ 0 & \text{otherwise} \end{cases} \quad (2)$$

Hence, we can use a binary logit model for estimation. For the estimation of the two outcome variables we employ five sets of explanatory variables X . In Specification 1 we only exploit the standardized test scores, whereas in Specification 2 we exclusively use the psychological assessments. Specification 3 combines both sets of explanatory variables. In Specification 4 we implement the reduced variables from the factor and cluster analysis. Finally, in Specification 5 we include the reduced variables from Specification 4 and add two more explanatory variables concerning entrepreneurial knowledge. Table 4 summarizes the strategy.

INSERT TABLE 4 ABOUT HERE

Table 5 contains the estimation results of the multinomial logit model for the whole sample and Table A.3 in the Appendix shows which coefficients were significant for the four subgroups.¹⁵ The coefficients have to be interpreted in relation to the base category,

¹⁴There is an ongoing discussion on the question of success measurement in the entrepreneurship literature. We chose the two measures employment status and hired employees for the following reasons. The variable employment status corresponds to previous ex-post analysis of the character-based approach and, thus, allows a comparison of our findings with previous results. The variable hired employees covers the crucial question of whether real entrepreneurship starts only if the firm owner hires additional persons.

¹⁵Full estimation results for the subgroups are available on request from the authors.

which in our case is unemployment. This means that a positive coefficient in the upper half of the table indicates a variable's positive influence on the probability of being in self-employment (compared to unemployment). The results in the lower part refer to the status regular employment.

INSERT TABLE 5 ABOUT HERE

Table 5 shows that with respect to *Hypothesis 1* there is one variable 'assertiveness' among the four tests of the questionnaire that has a significant effect in Specification 1. A higher score for this variable increases both the probability of being in self-employment and that of being in regular employment (relative to unemployment). Table A.3 reveals that this impact is observed for the subgroups of female and younger entrepreneurs. Moreover, 'need for achievement' is a second variable in the questionnaire data that is significant in the female subgroup.¹⁶

Using only the psychological assessments in Specification 2, we do not find any explanatory power for the model. That is, for the complete sample, none of the variables generated by psychological assessment are significant at a conventional level. Table A.3, however, illustrates that 'problem-solving orientation' has a significant impact for male and younger entrepreneurs and 'strong assertiveness' for male and older entrepreneurs.¹⁷ Combining both sets of variables in Specification 3 confirms the positive influence of the variable 'assertiveness' for the questionnaire data and also reveals a positive influence of the variable 'problem-solving orientation' for the psychological assessment.

A particularly interesting result with respect to *Hypothesis 1* can be found in Specification 3 for the four subgroups (see again Table A.3), namely that 'assertiveness' is the only variable which has a significant impact in all four subgroups, with the two screening methods—psychological assessment and questionnaire—working in a complementary way.

We have shown in Section 4.2 that the variables collected through psychological assessment are highly correlated between each other, and have conducted a factor analysis to condense the information to two factors 'entrepreneurial skills' and 'entrepreneurial knowledge'. We were also able to carry out a cluster analysis of the survey data. The results with respect to *Hypothesis 3* are presented in Specification 4 showing that the

¹⁶Additionally, men and older persons have a higher probability of being in regular employment.

¹⁷Older individuals now have a significantly lower probability of being in self-employment and regular employment.

factor ‘entrepreneurial skills’ has a positive influence on the probability to be in self-employment (and also on the probability to be in regular employment). Its explanatory power is increased in Specification 5, where we added two more independent variables (which themselves proved not to be significant). As to the subgroups, we find that the correlation between ‘entrepreneurial skills’ and self-employment holds again only for two subgroups: men and older persons. In contrast, the cluster variable of the test scores based on the questionnaire remains insignificant for all specifications and in all subgroups.

Besides the tests on the predictive power of personality characteristics, we also aim to find out whether the status quo of entrepreneurial knowledge has any explanatory power for an entrepreneur’s later development (*Hypothesis 4*). The estimation results are again shown for the whole sample in Table 5 and for the subgroups in Table A.3. For the complete sample, Specifications 3 and 5 reveal that none of the four variables (presentation clientele and finance, financial needs and basic competencies) has any significant impact. Similarly the factor ‘entrepreneurial knowledge’ extracted from the two presentation variables showed no predictive power on entrepreneurial success.¹⁸

With respect to the subgroups, it should be pointed out that for the female subgroup, a high score in the variable ‘presentation clientele’—the entrepreneurs’s knowledge about potential future clients—was positively correlated with the success variable. Even more interesting, for the male subgroup, we observed negative correlations between the factor entrepreneurial knowledge and entrepreneurial success.

The last findings needs to be commented. The negative significance of the factor entrepreneurial knowledge on self-employment observed for the male subgroup does not allow for the conclusion that male entrepreneurs will be more successful the less they know. As these persons started their business in an incubator with intensive training and coaching, this observation rather indicates that such training is able to compensate for a lack of entrepreneurial knowledge before the business was founded.

At the end of our empirical analysis, we will return to one important question mentioned briefly at the beginning of this paper: firm size in terms of number of employees, and the impact of personality characteristics on firm size. In most entrepreneurship research it is argued that real entrepreneurship starts only when the owner of the firm

¹⁸Interestingly, high levels of entrepreneurial knowledge previous to starting a business significantly increased the probability of later returning to regular employment but had no impact on self-employment. It seems that other employers also have an interest in this kind of knowledge.

hires at least one employee. Entrepreneurs are thus often distinguished from firm owners without any further employees, who are then classified as simply self-employed persons.

The advantage of our data set in comparison to the earlier empirical analysis is that we had access to the personality characteristics of potential founders before they started to run their own business, thus, before they knew whether they would one day have employees. Therefore, when it comes to firm size, we are able to make an analysis of our data without a normative distinction within the population of self-employed persons.

We subsequently analyze the success of the start-ups in terms of the number of employees. The descriptives in Table 2 showed that in our sample, roughly 30% of the former incubator clients had at least one employee at the time of the interview.¹⁹ Table 6 contains the results for the same five specifications discussed earlier in this section. The coefficients now have to be interpreted in the sense that entrepreneurs with at least one employee are compared with the base category, i.e. self-employed without further employees.

INSERT TABLE 6 ABOUT HERE

Interestingly, Table 6 shows that neither the variables derived from the questionnaire nor the psychological assessment of the personality characteristics, nor the human capital variables, nor the two factors extracted from the psychological assessment, nor the cluster variable derived from the test scores of the questionnaire show any significant differences between entrepreneurs with and those without further employees. The level of entrepreneurial skills and knowledge of business founders measured before their firms were launched seem to be the same, irrespective of the later size of the firm measured in terms of employees.

This result makes clear that other personality traits (if any) than those considered here might drive the decision to hire additional employees once a firm has been founded. As the prerequisites for managing others are found more in traits in the category of managerial skills (see, e.g., Miner, 1997), we may conclude that the character-based approach is not likely to make any prediction of whether a fairly high-skilled entrepreneur will run the business alone or employ others.

Putting all the results with respect to *Hypotheses 1, 3* and *4* together, we may conclude that among the personality characteristics believed crucial for entrepreneurial success,

¹⁹This corresponds to the overall share of previously unemployed entrepreneurs with further employees in their own business. For more details, see Caliendo, Kritikos, and Wießner (2006).

there is one variable—assertiveness—which proved to have a significantly positive impact on entrepreneurial success in all four subgroups, but only if the assessment methods are put together. Secondly, focusing on the entrepreneurial personality structure in a more general way, it showed that the factor entrepreneurial skills had some predictive power, while the factor entrepreneurial knowledge did not. Last but not least, the character-based approach is not able to distinguish consistently between entrepreneurs with and those without further employees.

With respect to the first finding—the impact of assertiveness—in all four subgroups, we need to return once more to the correlation analysis of the previous section: the two assessment methods were negatively (positively) correlated for the variable assertiveness in the subgroup of young (old) participants, and we suggested that younger persons might tend to be overconfident with respect to their skills. The present analysis, however, shows that the psychological assessment had some predictive power where the two methods were positively correlated (namely for the older persons) while the questionnaire had some predictive power when the two methods were negatively correlated. The latter observation shows that we do not necessarily have to deal with overconfidence and that in this case psychologists might have tended to underestimate younger entrepreneurs.

Before concluding, we should highlight one final result that proved to be more stable than any other variable in this analysis. The negative influence of the age dummy (both for self-employment and regular employment) remains significant over most specifications even when we differentiate between entrepreneurs with and those without additional employees. This result tells us that younger persons have a higher probability i) of remaining self-employed after making this decision and ii) of employing further persons when self-employed. They also have a higher probability iii) of returning to regular employment when they stop being self-employed for whatever reason.

5 Conclusions

The aim of this study has been to investigate the predictive power of the character-based approach. To do so, we collected information on those personality traits of potential business founders that were identified by psychological research as crucial for entrepreneurial success. We had access to data - before businesses had been launched - on the following

variables: ‘need for achievement’, ‘locus of control’, ‘problem-solving orientation’, ‘assertiveness’ and ‘interpersonal reactivity’. Most parameter values of these variables were collected by making use of two assessment methods: a closed-ended questionnaire and a one-day assessment center (AC) where trained psychologists conducted the analysis. In addition, we obtained information about the status quo of the specific entrepreneurial knowledge of the business founders.

We analyzed the extent to which each individual personality trait and the specific human capital as well as some extracted factors allow predictions of entrepreneurial development. Our results are surprising in part: first, there was almost no correlation between the two assessment methods. Second, among the observed variables of the psychological assessment, we found correlations for the complete data set, particularly between the extracted factor ‘entrepreneurial skills’ and entrepreneurial success, but for almost no single personality trait. Third, as to the test scores, the cluster analysis was insignificant, but the variable ‘assertiveness’ showed a positive impact.

Previous ex-post research found that the variables ‘need for achievement’ and ‘locus of control’ (more than the other three variables analyzed here) were positively correlated with entrepreneurial success. Our ex-ante analysis found no such correlation. Instead, we showed that the variable ‘assertiveness’ had an impact on the overall data analysis and in the four subgroups that we analyzed as well. Interestingly, the latter result was revealed only after making simultaneous use of both assessment methods. We furthermore found that the status quo of entrepreneurial knowledge had no predictive power. This observation is less surprising given that participants went through intensive training after the assessment. In this respect, it seems more important to emphasize the increasing significance of the factor ‘entrepreneurial skills’ as we added two variables referring to entrepreneurial knowledge. This combination reveals that it might be important for future research to focus on cognitive skills that make it possible to combine entrepreneurial knowledge with existing traits.

There are several further results that should be highlighted. Persons who started their own business but later returned to a position of a salaried employee after having been offered a—possibly more attractive—job had the same level of ‘entrepreneurial skills’ and were different from those persons who are still running their own business only insofar as the employees took *higher* values with respect to the variables on entrepreneurial knowl-

edge. More importantly, for the subgroup of the entrepreneurs who had hired additional employees in their firm, both assessment methods found no significant differences when this subgroup was compared to entrepreneurs working alone. The last finding has two consequences: 1) The level of entrepreneurial knowledge and skills seem to have no impact on the decision whether the owner of the firm will employ further persons or not. 2) As the variables above discussed are considered crucial for entrepreneurship, the frequently proposed distinction between ‘real entrepreneurs’ (with further employees) and small-business owners without further employees has to be reevaluated. The two groups cannot be differentiated with respect to their personality characteristics, at least when observed before businesses were launched.

These findings allow us to draw several conclusions. First, the predictive power of a specifically designed assessment center is slightly better than the questionnaire.²⁰ Moreover, this study makes clear that it might be useful to combine both methods—psychological assessment by well trained third parties and self-evaluation through a validated questionnaire (as was done at the incubator in Hamburg)—and to use this information to improve decision-making processes on whether to become an entrepreneur. However, predicting entrepreneurial success based on these two assessment methods is not possible at this time. Moreover, for potential founders who aim to start a larger business, it seems that further skills in addition to those observed here would be crucial as well.

The results of the character-based approach remain below the expectations raised by entrepreneurship theory. Nevertheless, it is worth analyzing whether the two assessment methods, when combined, are a better predictor of entrepreneurial success than the scoring models currently used by banks. From a general point of view, our analysis leaves open whether the right variables were identified to capture entrepreneurial behavior, whether the observed variables are stable over time, whether support measures like an incubator service have an impact on the personality structure, and whether the methods of assessing potential entrepreneurs need to be improved. On another note, further measurements of entrepreneurial success have to be developed. To this end additional research is needed.

²⁰This observation is interesting as research on the predictive power of the two assessment methods in the field of employment mostly found the opposite, see, e.g., Schmidt and Hunter (1998).

References

- ALDRICH, H., AND G. WIEDENMAYER (1993): "From Traits to Rates: An Ecological Perspective on Organizational Foundings," *Advances in Entrepreneurship, Firm Emergence, and Growth*, 1, 145–195.
- ARENIUS, P., AND M. MINNITI (2005): "Perceptual Variables and Nascent Entrepreneurship," *Small Business Economics*, 24, 233–247.
- BACKES-GELLNER, U., AND E. P. LAZEAR (2003): "Entrepreneurs and Specialists: Jack-of-all-Trades or Master of One?," Draft, University of Zurich.
- BARON, R. (2000): "Psychological Perspectives of Entrepreneurship: Cognitive and Social Factors in Entrepreneur's Success," *Current Directions in Psychological Science*, 9, 275–294.
- BAUM, J. (1995): "The Relation of Traits, Competencies, Motivation, Strategy, and Structure to Venture Growth," in *Frontiers of Entrepreneurship Research*, ed. by W. Bygrave. Wellesley Mass: Babson Mark Mass: Babson College.
- BEGLEY, T., AND D. BOYD (1987): "Psychological Characteristics Associated with Performance in Entrepreneurial Firms and Small Businesses," *Journal of Business Venturing*, 2, 79–93.
- BIANCHI, M., AND M. HENREKSON (2005): "Is Neoclassical Economics still Entrepreneurless?," *Kyklos*, 58, 353–377.
- BIERHOFF, H. W., AND G. MÜLLER (1993): "Kooperation in Organisationen," *Zeitschrift für Arbeits- und Organisationspsychologie*, 37, 42–51.
- BLANCHFLOWER, D., AND A. OSWALD (1998): "What makes an entrepreneur?," *Journal of Labor Economics*, 16, 26–60.
- BONNET, C., AND A. FURNHAM (1991): "Who wants to be an entrepreneur? A study of adolescents interested in a young enterprise scheme," *Journal of Economic Psychology*, 12, 465–478.
- BRANDSTÄTTER, H. (1997): "Becoming an entrepreneur — a question of personality structure?," *Journal of Economic Psychology*, 18, 157–177.
- BRÜDERL, J., P. PREISENDÖRFER, AND R. ZIEGLER (1992): "Survival Chances of Newly Founded Business Organisations," *American Sociological Review*, 57, 227–242.
- BRÜDERL, J., AND R. SCHÜSSLER (1990): "Organizational Mortality: The Liabilities of Newness and Adolescence," *Administrative Science Quarterly*, 35, 530 – 547.
- BUTTNER, E., AND N. GRYSKIEWICZ (1993): "Entrepreneurs' Problem-Solving Styles: An Empirical Study Using the Kirton Adaption/Innovation Theory," *Journal of Small Business Management*, 31, 22–31.
- CALIENDO, M., F. FOSSEN, AND A. KRITIKOS (2006): "Risk Attitudes of Nascent Entrepreneurs: New Evidence from an Experimentally-Validated Survey," Discussion Paper No. 2168, IZA, Bonn.
- CALIENDO, M., A. KRITIKOS, AND F. WIESSNER (2006): "Existenzgründungsförderung in Deutschland - Zwischenergebnisse aus der Hartz-Evaluation," *Journal of Labor Market Research*, 39(3-4), 503–529.
- CHANDLER, G., AND S. HANKS (1994): "Founder Competence, the Environment, and Venture Performance," *Entrepreneurship Theory and Practice*, 18, 77–89.

- (1996): “An Examination of the Substitutability of Founders Human and Financial Capital in Emerging Business Ventures,” *Journal of Business Venturing*, 13, 173–204.
- CHELL, E., J. HARWORTH, AND S. BREARLEY (1991): “The search for entrepreneurial traits,” in *The entrepreneurial personality*, ed. by E. Chell, J. Harworth, and S. Brearley, pp. 29–53.
- CONRAD, W., G. MÜLLER, D. WAGENER, AND O. WILHELM (1998): “Psychologische Beiträge zur Bestimmung unternehmerischer Potenziale bei Existenzgründern,” Unpublished research report, Universität Mannheim: Institut für Mittelstandsforschung.
- COOPER, A., AND F. GIMENO-GASCON (1992): “Entrepreneurs, Process of founding, and new-firm performance,” in *The State of the Art of Entrepreneurship*, ed. by D. Sexton, and J. Kasarda, pp. 301–340. Boston.
- DEAN, T., AND G. MEYER (1996): “Industry Environments and New Venture Formations in the U.S. Manufacturing: A Conceptual and Empirical Analysis of Demand Determinants,” *Journal of Business Venturing*, 11, 107–132.
- DUNN, T., AND D. HOLTZ-EAKIN (2000): “Financial Capital, Human Capital, and the Transition to Self-Employment: Evidence from Intergenerational Links,” *Journal of Labor Economics*, 18, 282–305.
- EVANS, D., AND B. JOVANOVIC (1989): “An Estimated Model of Entrepreneurial Choice under Liquidity Constraints,” *Journal of Political Economy*, 97, 808–827.
- FURNHAM, A. (1986): “Economic locus of control,” *Human Relations*, 39, 29–43.
- (1992): *Personality and Productivity*. Routledge, London.
- GARTNER, W. (1988): “Who is an Entrepreneur? is the wrong question,” *Entrepreneurship Theory and Practice*, 12, 47–68.
- GOEBEL, S., AND M. FRESE (1999): “Persönlichkeit, Strategie und Erfolg bei Kleinunternehmern,” in *Unternehmerisch erfolgreiches Handeln*, ed. by K. Moser, B. Batinic, and J. Zempel. Hofgreffe, Göttingen.
- GREEN, R., R. DAVID, AND M. DENT (1996): “The Russian Entrepreneur: A Study of Psychological Characteristics,” *International Journal of Entrepreneurial Behavior*, 2, 49–58.
- HANNAN, M., AND J. FREEMAN (1977): “The Population Ecology of Organizations,” *American Journal of Sociology*, 82, 929–964.
- HARTOG, J., A. FERRER-I CARBONELL, AND N. JONKER (2002): “Linking Measured Risk Aversion to Individual Characteristics,” *Kyklos*, 55, 3–26.
- HISRICH, R. (1990): “Entrepreneurship/Intrapreneurship,” *American Psychologist*, 45, 209–222.
- HOLMES, T., AND J. SCHMITZ (1990): “A Theory of Entrepreneurship and its Application to the Study of Business Transfer,” *Journal of Political Economy*, 98, 265–294.
- KIHLSTROM, R., AND J. LAFFONT (1979): “A General Equilibrium Theory of Firm Formation Based on Risk Aversion,” *Journal of Political Economy*, 87, 719–748.
- KING, A. (1985): “Self-analysis and assessment of entrepreneurial potential,” *Simulation & Games*, 16, 399–416.
- KLANDT, H. (1984): *Aktivität und Erfolg des Unternehmensgründers: Eine empirische Analyse unter Einbeziehung des mikrosozialen Umfelds*. Bergisch Gladbach.

- (1996): *Der integrierte Unternehmensplan - Ein Instrument für die Gründungsplanung*. Dortmund.
- KÖLLINGER, P., M. MINITTI, AND C. SCHADE (2005): “I think I can, I think I can”: Overconfidence and Entrepreneurial Behavior,” Discussion Paper 501, DIW.
- KRITIKOS, A., AND F. WIESSNER (2004): “Existenzgründungen: Die richtigen Typen sind gefragt,” *Bundesarbeitsblatt*, (6), 18–23.
- LAZEAR, E. P. (2004): “Balanced Skills and Entrepreneurship,” *American Economic Review*, 94, 208–211.
- LUCAS, R. (1978): “On the Size Distribution of Business Firms,” *Bell Journal of Economics*, 9, 508–523.
- LUMKIN, G., AND G. DESS (1996): “Clarifying the entrepreneurial orientation construct and linking it to performance,” *Academy of Management Review*, 21, 135–172.
- MACMILLAN, I., AND J. KATZ (1992): “Idiosyncratic milieus of entrepreneurial research: the need for comprehensive theories,” *Journal of Business Venturing*, 7, 1–7.
- MCCLELLAND, D. (1961): “The Achievement Motive in Economic Growth,” *American Economic Review*, 51, 179–189.
- (1985): *Human Motivation*. Glenview.
- MCCLELLAND, D. (1987): “Characteristic of successful entrepreneurs,” *Journal of Creative Behavior*, 3, 219–233.
- MINER, J. (1997): “A Psychological Typology and its Relationship to Entrepreneurial Success,” *Entrepreneurship and Regional Development*, 9, 319–334.
- (2000): “Testing a Psychological Typology of Entrepreneurship Using Business Founders,” *The Journal of Applied Behavioral Science*, 36, 43–69.
- MÜLLER, G. (1999): “Persönlichkeit und selbständige Erwerbstätigkeit - Messung von Potenzialfaktoren und Analyse ihres Einflusses,” *Wirtschaftspsychologie*, 6, 2–12.
- MÜLLER, G., AND C. GAPPISCH (2005): “Personality Types of Entrepreneurs,” *Psychological Reports*, 96, 737–746.
- PICOT, A., U. LAUB, AND D. SCHNEIDER (1989): *Innovative Unternehmensgründungen*. Springer, Berlin.
- PORTER, M. (1981): “The Contribution of Industrial Organization to Strategic Management,” *The Academy of Management Review*, 6, 609–620.
- RAHIM, A. (1996): “Stress, Strain, and their Moderators: An Empirical Comparison of Entrepreneurs and Managers,” *Journal of Small Business Management*, 34, 46–58.
- RAUCH, A., AND M. FRESE (2000): “Psychological Approaches to Entrepreneurial Success: A General Model and an Overview of Findings,” in *International Review of Industrial and Organizational Psychology*, ed. by C. Cooper, and I. Robertson, pp. 101–142. Wiley.
- ROBINSON, P., D. STIMPSON, J. HUEFNER, AND H. HUNT (1991): “An Attitude Approach to the Prediction of Entrepreneurship,” *Entrepreneurship Theory and Practice*, 2, 13–31.
- ROTTER, J. B. (1966): *Generalized expectancies for internal versus external control of reinforcement*. Psychological Monographs 80.

- SCHMIDT, F., AND J. HUNTER (1998): “Messbare Personenmerkmale: Stabilität, Variabilität und Validität zur Vorhersage zukünftiger Berufsleistung und berufsbezogenen Lernens,” in *Potentialfeststellung und Personalentwicklung*, ed. by M. Kleinmann, and B. Strauss, pp. 16–43. Hogrefe, Göttingen.
- SHANE, S., AND L. KOLVEREID (1995): “National Environment, Strategy, and New Venture Performance: A Three-Country Study,” *Journal of Small Business Management*, 29, 37–50.
- SIEWERTSEN, H., AND J. EVERS (2005): “Policy measures to promote the use of micro credit for social inclusion,” Study, conducted on behalf of the European Commission DG Employment unit E/2, Brussels.
- SING, J. (1990): “Organizational Ecology and Organizational Evolution,” in *Organizational Evolution: New Directions*, ed. by J. Sing, pp. 11–20. Sage, London.
- SWAMINATHAN, A. (1996): “Environmental Conditions at Founding and Organizational Mortality: A Trial-by-Fire Model,” *Academy of Management Journal*, 39, 1350–1377.
- WAGNER, J. (2003): “Testing Lazear’s Jack-of-all-Trades View of Entrepreneurship with German Micro Data,” *Applied Economics Letters*, 10, 687–689.
- WILLIAMSON, O. (1985): *The Economic Institutions of Capitalism - Firms, Markets, Rational Contracting*. New York.
- WINSLOW, E., AND J. SOLOMON (1987): “Entrepreneurs are more than non-conformists: They are mildly sociopathic,” *Journal of Creative Behavior*, 21, 203–205.
- WÄRNERYD, K.-E. (1988): “The psychology of innovative entrepreneurship,” in *Handbook of economic psychology*, ed. by W. van Raaij, G. van Veldhoven, and K.-E. Wärneryd, pp. 104–117. Kluwer.

Tables

Table 1: Personality Characteristics, Empirical Findings and Screening Methods

Personality Characteristic	Empirical Findings with significant differences	Screening Method	Expected Effect
Need for Achievement	McClelland (1987), Begley and Boyd (1987), Geen et al. (1996), Müller (1999b), Goebel and Frese (1999)	Psych. Test 1	AC and positive
Locus of Control	King (1985), Bonnet and Furnham (1991), Rahim (1996), Müller (1999b), Goebel and Frese (1999)	Test 2	positive
Problem-Solving Orientation	King (1985), Buttner and Gryskiewicz (1993), Müller (1999b)	Psych. Test 3	AC and positive
Interpersonal Reactivity Assertiveness	Baron (2000) King (1985), Chell et al. (1991), Brandstätter (1997), Müller (1999b)	Psych. Test 4	AC and positive

AC: Assessment Center.

Table 2: Description of the Variables and Summary Statistics

Variables	All	Age		Gender	
		< 30	> 30	Men	Women
Number of Observations	414	198	216	259	155
Age (1 = over 30 years)	0.52	–	–	0.56	0.45
Gender (1 = Men)	0.63	0.57	0.68	–	–
Standardized Test (Measure of the applicant's ...)					
1. Need for achievement	3.99	3.97	4.01	3.88	4.17
2. Locus of control	3.22	3.20	3.24	3.20	3.24
3. Problem-solving orientation	3.67	3.54	3.80	3.66	3.70
4. Assertiveness	1.82	1.74	1.87	1.84	1.77
Psychological Evaluations					
Basic Competences ^a	0.94	0.91	0.96	0.94	0.93
Financial Needs ^b	0.41	0.41	0.42	0.45	0.35
Presentation: Clientele ^c	1.94	1.51	2.33	1.99	1.86
Presentation: Finance ^d	2.13	2.11	2.15	2.13	2.14
Need for achievement ^e	1.80	1.64	1.94	1.76	1.85
Problem-solving orientation ^f	1.95	1.91	2.00	1.92	2.01
Assertiveness/Interpersonal reactivity(in %)					
Weak assertiveness and weak interpersonal reactivity	0.24	0.32	0.16	0.24	0.23
Weak assertiveness and strong interpersonal reactivity	0.36	0.42	0.31	0.37	0.34
Strong assertiveness and weak interpersonal reactivity	0.27	0.20	0.33	0.25	0.30
Equally assertive and interpersonal reactive	0.12	0.05	0.19	0.13	0.11
Outcome Variables					
Employment Status (in %)					
Self-employed	0.75	0.76	0.75	0.74	0.77
Salaried worker	0.12	0.14	0.10	0.14	0.09
Unemployed	0.10	0.05	0.15	0.11	0.09
Education + other	0.03	0.06	–	0.02	0.05
New Employment (1 = Yes)	0.28	0.32	0.23	0.31	0.22
Number of Employed Persons	3.57	4.30	2.65	3.78	3.08

^a 1 - if the applicant has earlier experience in the business area he wants to work in, 0 - otherwise

^b 1 - if the applicant had a clear financial plan for the initial phase, 0 - otherwise

^c Shows whether the applicant knew his future clientele: 1 - no, 2 - partly, 3 - very well

^d Shows whether the applicant knew how to finance his business: 1 - no, 2 - partly, 3 - very well

^e 1 - weak, 2 - intermediate, 3 - strong

^f Measures the applicant's combinatorial thinking ability: 1 - low ability, 2 - intermediate ability, 3 - high ability

Table 3: Pairwise Correlation Coefficients

	Test 1	Test 2	Test 3	Test 4	
Test 1	1.000				
Test 2	0.238*	1.000			
Test 3	0.175*	0.191*	1.000		
Test 4		0.084		1.000	
Need for achievement					
Problem-solving orientation		0.086	0.086		
Assertiveness					
Presentation: Client					
Presentation: Finance	0.099*				
	Ach.Mot.	Comb. Think.	Assert	Pres. Client	Pres. Finance
Need for achievement	1.000				
Problem-solving orientation	0.370*	1.000			
Assertiveness	0.533*	0.438*	1.000		
Presentation: Client	0.325*	0.113*	0.293*	1.000	
Presentation: Finance	0.205*		0.152*	0.282*	1.000

Printed if significant at the 10 %-level, * indicates significance at the 5 %-level.

Table 4: Overview of the Different Specifications

Variables	Spec. 1	Spec. 2	Spec. 3	Spec. 4	Spec. 5
Standardized Tests					
1. Need for achievement	<i>X</i>		<i>X</i>		
2. Locus of control	<i>X</i>		<i>X</i>		
3. Problem-solving orientation	<i>X</i>		<i>X</i>		
4. Assertiveness	<i>X</i>		<i>X</i>		
Cluster variable of Test-Scores				<i>X</i>	<i>X</i>
Psychological Evaluations					
Need for achievement		<i>X</i>	<i>X</i>		
Problem-solving orientation		<i>X</i>	<i>X</i>		
Assertiveness/Interpersonal re-activity		<i>X</i>	<i>X</i>		
Presentation: Clientele		<i>X</i>	<i>X</i>		
Presentation: Finance		<i>X</i>	<i>X</i>		
Factor Analysis: Entrepreneurial skills				<i>X</i>	<i>X</i>
Factor Analysis: Entrepreneurial knowledge				<i>X</i>	<i>X</i>
Other					
Basic Competences					<i>X</i>
Financial Needs					<i>X</i>

X indicates that the variable is included in the specification.

Spec. 1: Consists of standardised test scores only.

Spec. 2: Consists of psychological evaluations only.

Spec. 3: Combines standardised tests and psychological evaluations.

Spec. 4: Combines reduced forms of standardised tests and psychological evaluations.

Spec. 5: Combines reduced forms of standardised tests and psychological evaluations and two additional explanatory variables.

Table 5: Multinomial Logit Estimation Results: Employment Status (Reference Category: Unemployed)

	Spec. 1	Spec. 2	Spec. 3	Spec. 4	Spec. 5
Self-Employed					
Gender (1 = Men)	0.218	0.043	0.129	0.091	0.123
Age (1 = > 30)	-0.413	-0.899*	-0.815+	-0.52	-0.708+
Standardized Test (Measure of the applicant's ...)					
Need for achievement	0.146		0.177		
Locus of control	-0.002		-0.068		
Problem-solving orientation	0.019		0.004		
Assertiveness	0.345*		0.369*		
Need for achievement		-0.028	-0.117		
Problem solving orientation		0.339	0.447+		
Assertiveness/Interpersonal reactivity (Ref. weak assertiveness and weak interpersonal reactivity)					
Weak assertiveness and strong interpersonal reactivity		0.028	-0.237		
Strong assertiveness and weak interpersonal reactivity		0.687	0.939		
Equally assertive and interpersonal reactive		0.065	-0.055		
Presentation: Clientele		0.334	0.293		
Presentation: Finance		-0.228	-0.326		
Skills				0.418+	0.548*
Knowledge				-0.112	0.036
Cluster variable of Testscores				0.046	0.117
Financial Needs					0.026
Basic Competencies					0.186
Constant	0.669	1.367+	0.505	2.100**	1.968*
Regular Employed					
Gender (1 = Men)	0.750+	0.603	0.66	0.627	0.693
Age (1 = > 30)	-0.903*	-1.480**	-1.467*	-1.355**	-1.341*
Standardized Test (Measure of the applicant's ...)					
Need for achievement	0.164		0.192		
Locus of control	-0.016		-0.091		
Problem-solving orientation	0.107		0.135		
Assertiveness	0.22		0.277		

Continued on next page

	Spec. 1	Spec. 2	Spec. 3	Spec. 4	Spec. 5
Need for achievement		-0.24	-0.252		
Problem-solving orientation		0.768*	0.823*		
Assertiveness/Interpersonal reactivity (Ref. weak assertiveness and weak interpersonal reactivity)					
Weak assertiveness and strong interpersonal reactivity		-0.312	-0.641		
Strong assertiveness and weak interpersonal reactivity		0.572	0.806		
Equally assertive and interpersonal reactive		-0.379	-0.581		
Presentation: Clientele		0.511	0.509		
Presentation: Finance		0.307	0.233		
Skills				0.47	0.485
Knowledge				0.365	0.557
Cluster variable of Testscores				-0.299	-0.293
Financial Needs					0.833+
Basic Competencies					-0.569
Constant	-1.443	-2.409*	-3.634*	0.382	0.366
R-Squared	0.021	0.047	0.065	0.026	0.043
Log-Likelihood	-279.246	-276.564	-258.609	-269.209	-237.656
Observations	394	399	382	382	347

Significance levels: + 10 %, * 5 %, ** 1 %.

Table 6: Logit Estimation Results: At Least One Employee vs. None

	Spec. 1	Spec. 2	Spec. 3	Spec. 4	Spec. 5
Gender (1 = Men)	0.411	0.383	0.261	0.278	0.173
Age (1 = > 30)	-0.577*	-0.314	-0.351	-0.402	-0.44
Standardized Test (Measure of the applicant's ...)					
Need for achievement	-0.033		-0.096		
Locus of control	0.013		0.012		
Problem solving orientation	-0.098		-0.09		
Assertiveness	0.154		0.107		
Need for achievement		-0.305	-0.294		
Problem-solving orientation		-0.01	0		
Assertiveness/Interpersonal reactivity (Ref. weak assertiveness and weak interpersonal reactivity)		-0.041	-0.082		
Strong assertiveness and strong interpersonal reactivity		0.009	-0.103		
Equally assertive and interpersonal reactivity		-0.145	-0.19		
Presentation: Clientele		-0.057	-0.033		
Presentation: Finance		0.168	0.128		
Skills				-0.224	-0.304
Knowledge				-0.028	0.079
Cluster variable of Testscores				0.148	0.068
Financial Needs					0.429
Basic Competencies					-0.472
Constant	-0.784	-0.731	-0.119	-1.010**	-0.586
R-Squared	0.024	0.022	0.027	0.02	0.03
Log-Likelihood	-170.09	-170.428	-163.067	-164.311	-150.096
Observations	295	298	286	286	261

Significance levels: + 10 %, * 5 %, ** 1 %.

A Supplementary Tables

Table A.1: Pairwise Correlation Coefficients – Differentiated by Gender

	Test 1	Test 2	Test 3	Test 4	Ach.Mot.	Comb. Think.	Assert	Pres. Client	Pres. Finance
Men									
Test 1	1.000								
Test 2	0.275*	1.000							
Test 3	0.175*	0.162*	1.000						
Test 4	0.108	0.132*		1.000					
Need for Achievement					1.000				
Problem-solving orientation					0.355*	1.000			
Assertiveness		0.106			0.547*	0.460*	1.000		
Pres. Client					0.316*		0.284*	1.000	
Pres. Finance					0.221*		0.181*	0.315*	1.000
Women									
Test 1	1.000								
Test 2	0.171*	1.000							
Test 3	0.175*	0.240*	1.000						
Test 4	-0.165*			1.000					
Need for Achievement					1.000				
Problem-solving orientation		0.170*			0.388*	1.000			
Assertiveness					0.510*	0.403*	1.000		
Pres. Client					0.356*	0.153	0.312*	1.000	
Pres. Finance					0.177*			0.231*	1.000

Printed if significant at the 10 %-level, * indicates significance at the 5 %-level.

Table A.2: Pairwise Correlation Coefficients – Differentiated by Age

	Test 1	Test 2	Test 3	Test 4	Engag.	Comb. Think.	Assert	Pres. Client	Pres. Finance
Age < 30									
Test 1	1.000								
Test 2	0.201*	1.000							
Test 3	0.227*	0.296*	1.000						
Test 4				1.000					
Need for Achievement	-0.144*	-0.162*			1.000				
Problem-solving orientation	-0.142*			-0.133	0.395*	1.000			
Assertiveness	-0.141			-0.169*	0.531*	0.503*	1.000		
Pres. Client					0.235*		0.154*	1.000	
Pres. Finance								0.270*	1.000
Age > 30									
Test 1	1.000								
Test 2	0.269*	1.000							
Test 3	0.122		1.000						
Test 4				1.000					
Need for Achievement	0.255*	0.161*			1.000				
Problem-solving orientation		0.147*		0.138	0.343*	1.000			
Assertiveness	0.144*	0.166*		0.154*	0.477*	0.394*	1.000		
Pres. Client					0.259*	0.119	0.145*	1.000	
Pres. Finance	0.186*				0.298*		0.233*	0.365*	1.000

Printed if significant at the 10 %-level, * indicates significance at the 5 %-level.

Table A.3: Multinomial Logit Estimation: Employment Status^(a)

Variables	Gender		Age	
	Men	Women	< 30	> 30
Standardized Test (Measure of the applicant´s ...)				
Need for achievement	0/0	+/+	0/0	0/+
Locus of control	0/0	0/0	0/0	0/0
Problem-solving orientation	0/0	0/+	0/0	0/0
Assertiveness	0/0	+/0	+/+	0/0
Need for achievement	0/0	0/0	0/0	0/0
Problem solving orientation	+/+	0/0	+/+	0/0
Assertiveness/Interpersonal reactivity (Ref. weak assertiveness and weak interpersonal reactivity)				
Weak assertiveness and strong interpersonal reactivity	0/0	0/0	0/0	0/0
Strong assertiveness and weak interpersonal reactivity	+/0	0/0	0/0	+/0
Equally assertive and interpersonal reactive	0/0	0/-	0/0	0/0
Presentation: Clientele	0/0	+/0	0/0	0/0
Presentation: Finance	0/0	0/0	0/0	0/0
Entrepreneurial skills	+/+	0/0	0/0	+/0
Entrepreneurial knowledge	-/0	0/0	0/0	0/0
Cluster variable of Testscores	0/0	0/0	0/0	0/0
Financial Needs	0/0	0/0	0/0	0/+
Basic Competencies	0/0	0/0	0/0	0/0

⁺ indicates a significant (at least on the 10% level) positive coefficient

⁻ indicates a significant (at least on the 10% level) negative coefficient

⁰ indicates no significant influence

^(a) The coefficients from the multinomial logit model have to be interpreted in relation to the base category, which is unemployment in our case. The first sign in each cell corresponds to self-employment, the second one to regular employment. For example, the combination (0/+) in the last column of line 1 means, that the variable achievement motivation has no significant effect on the probability to be in self-employment (relative to unemployment) but increases the probability to be in regular employment (relative to unemployment).

Table A.4: Logit Estimation Results: At Least One Employee vs. None

Variables	Gender		Age	
	Men	Women	< 30	> 30
Standardized Test (Measure of the applicant´s ...)				
Need for achievement	0	0	0	0
Locus of control	0	0	+	-
Problem-solving orientation	0	0	0	0
Assertiveness	0	0	0	0
Need for achievement	0	0	-	0
Problem solving orientation	0	-	0	0
Assertiveness/Interpersonal reactivity (Ref. weak assertiveness and weak interpersonal reactivity)				
Weak assertiveness and strong interpersonal reactivity	0	0	0	0
Strong assertiveness and weak interpersonal reactivity	0	0	0	0
Equally assertive and interpersonal reactive	0		0	0
Presentation: Clientele	0	0	0	0
Presentation: Finance	0	0	0	0
Skills	0	-	-	0
Knowledge	0	0	0	0
Cluster variable of Testscores	0	-	0	+
Financial Needs	0	0	0	0
Basic Competencies	0	0	0	0

⁺ indicates a significant (at least on the 10% level) positive coefficient

⁻ indicates a significant (at least on the 10% level) negative coefficient

⁰ indicates no significant influence