

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

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Abstract

This paper empirically analyses whether the character-based approach which is based on the personality and on 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 the one 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 hired employees both methods are poor predictors.

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

JEL Classification: M13, J23, C13

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1 Introduction

Entrepreneurship is characterized by a special kind of decision making processes. Therefore, it is argued that not every person is suited to become an entrepreneur, in particular when he or she was previously unemployed. Failure rates of entrepreneurs are considerably high. And so are the costs thereby incurred: The founders of the businesses may lose their own investment and other income opportunities which they could have realized otherwise; banks or ‘friends, fools and family’ may lose their invested capital (in terms of loans or private equity); government agencies may misallocate tax money when they support entrepreneurs with monthly lump sum payments (like the bridging allowance in Germany or similar support schemes offered in many other countries), with free access to seminars, vocational training or coaching or with subsidized loan products.¹ Thus, the decision to become an entrepreneur might be a great chance for generating income and a source for an inefficient allocation of private and public money, at the same time. Insofar, many stakeholders are interested into the crucial question: To what extent is entrepreneurial success predictable?

In this context, several psychologists and economists² proposed that it is the personality of an entrepreneur who has a strong impact on the eventual success of a firm, in particular when the firm is run by the entrepreneur alone or if there are only a few employees in the firm. Psychologists identified several variables which are supposed to have a substantial influence on entrepreneurial success. These variables focus either on the human capital, i.e. more specifically on the entrepreneurial knowledge of founders, or on those personality characteristics which are important for developing entrepreneurial skills, such as “need for achievement”, “locus of control”, “problem-solving Orientation”, “interpersonal reactivity” and “assertiveness”. Both, personality characteristics and entrepreneurial knowledge put together, define the character-based approach. As most psychologists further assume that the personality of human beings consists of given traits which are stable over time, it is expected that in particular the personality characteristics fulfil all prerequisites of allowing prediction of future success.³

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

²For excellent surveys over the research in psychological sciences, see Rauch and Frese (2000), and in economic sciences, see Bianchi and Henrekson (2005).

³There is an on-going discussion 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

The impact of these traits on entrepreneurship has been empirically tested already, in particular by making use of psychologically validated questionnaires (see, e.g., King, 1985). So far tests have been made only ex-post in two ways: Traits of successful entrepreneurs were either compared with the same traits of employees or of unsuccessful entrepreneurs. Both comparisons showed that there are significant differences between the personality of successful entrepreneurs and the personality of the other two groups.

In this paper, we investigate (to our knowledge) for the first time whether it is possible to predict the development of a business ex-ante by applying the character-based approach. Furthermore as well for the first time, we make use of three independent methods of examining the parameter values of the traits and the human capital status for every potential entrepreneur: First, a questionnaire where participants had to answer to close-ended questions, second, an assessment method where participants were given specific tasks while psychologists observe their performance, and third, a presentation of the business idea where information was gathered with respect to the status quo of each founder's specific human capital being relevant for running an own business. We are able to use a data set of a business incubator situated in the city of Hamburg where these methods were simultaneously applied to screen individuals *before* they started to run their business. In Section 2, we describe the assessment methods.

Once the screening methods are explained, the variables have to be identified which are assumed to be crucial for entrepreneurial development. In particular, research in the psychological sciences has suggested that the personality traits mentioned earlier in this section are candidate variables. Hence, we will review these variables which are assumed to have an impact on the later success of a potential founder in Section 3.

In Section 4 we present and analyse the unique data set consisting of 414 business-founders who were assessed and who then received support at that specific business incubator. We combine these data with a second, short questionnaire which only asked for actual employment status and the size of the business. Thereby, we are able to make two kind of analysis: We start with examining the correlations between the different assessment methods before we analyze in an ex-ante test to what extent these variables are able to predict the prospective success of a business. Section 5 concludes the findings.

experience of a person as self-employed (see inter alia MacMillan and Katz, 1992). Empirical evidence in favour of the stability hypothesis was found by Brandstätter (1997) and Müller (1999); in favour of the socialisation hypothesis by Blanchflower and Oswald (1998). The latter authors conclude that "psychology apparently does not play a key role in determining who becomes an entrepreneur".

2 Data Source

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 to these persons consists of an “integrated concept” lasting over six months which combines the transfer of knowledge with the training of skills and with structured feedback on the first actions of these founders as entrepreneurs.⁵ Persons looking for this kind of support were directed to a one-day assessment centre (AC) conducted by two trained psychologists and two laypersons. The purpose of the screening process was to inform the team of the incubator about the skills and the level of pre-existing knowledge of the candidates at the date of their entry into the incubator.

As the AC aims to evaluate the basic entrepreneurial knowledge and skills of all applicants, it uses three independent tools for the evaluation: a standardised 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 all applicants’ 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 among three response alternatives which mostly corresponds to the preference of the asked person. For each question, there is only one answer matching with the trait which is to be tested. Each person’s test score is the higher the more often the chosen response corresponded to the aptitude associated with the trait which should be measured by a certain item. 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. In the next section, we will mention for each variable whose predictive power will be tested in this paper, whether we have access to data based on the questionnaire.

⁴The classification of our sample is close to the definition of entrepreneurship as it is done by Hisrich (1990). The only important difference is that the persons we observe in our sample have not yet started their business. They neither know for sure whether they will indeed start their business nor whether they will be only self-employed or whether they will employ any further persons. For a discussion on the issue of a right definition of entrepreneurs, see e.g., Rauch and Frese (2000). There are in particular some approaches claiming that entrepreneurship starts only if the firm owner has at least one employee.

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

The second screening method is similar to a classical assessment center. 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, they were observed by two psychologists and two laypersons to what extent certain personality traits such as for instance “problem solving orientation”, “assertiveness” or “need for achievement” occurred at each participant. Thus, the observers focused on the behaviour 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 behaviour into scaled parameters of personality traits. In the next section, we will mention for which variables we have access to data based on the psychological evaluation and for which variables we have two independent evaluation methods.

Last but not least, the potential founders had to present their business idea during the assessment centre. Applicants were informed before their presentation that they should provide specific information about their business idea, for instance about the target group of the planned products or the financial means they need to start their business. Accordingly, the third screening method - again extracted by the psychologists - focussed on parameter values of entrepreneurial knowledge of each applicant.

Having clarified the method how the variables of interest were gathered, we will now describe which variables were collected by these screening methods and shortly analyze why exactly these variables were chosen.

3 The Character-Based Approach

Theoretical analysis on key factors of entrepreneurial success has been manifold. As our empirical analysis concentrates on the predictive power of the character-based approach which is composed of the personality characteristics and the human capital of an entrepreneur, we will discuss in this section only related models of entrepreneurial success. It should be highlighted that there are other important models, as well analyzing the development of small firms like the business-oriented or the environmental approach.⁶

⁶For overviews over the business oriented approach, see, e.g., Porter (1981), Klandt (1984), Williamson (1985), Picot et al. (1989), Brüderl et al. (1992). The empirical analysis on the business oriented approach are numerous. See inter alia Blanchflower and Oswald (1998) or Evans and Jovanovic (1989) who showed

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 were defined as of being useful in explaining past and in predicting future development of a business foundation: several motivational traits, among them “need for achievement”, the “internal locus of control”, and the “need for autonomy”, several cognitive skills such as “problem solving orientation”, “tolerance of ambiguity”, “creativity” and “risk-taking propensity”, affective personality traits, including “stress resistance”, “emotional stability”, or the “level of arousal”, as well as several social skills, among them “interpersonal reactivity” and “assertiveness”.⁷ Empirical research aiming to underpin the theoretical propositions has been conducted ex-post in two directions: The parameter values of these variables, gathered with the help of psychologically validated questionnaires, were either compared between entrepreneurs and employees or between successful and unsuccessful entrepreneurs.

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

The first 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 et al. (1996) and Müller

that the amount of available capital is correlated with the success rate of a newly found business. For some theoretical background and empirical analysis 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).

⁷The research on these variables is already numerous in psychology. For extensive discussions on the impact of these variables on the entrepreneurial success, see e.g., Rotter (1966), McClelland (1961, 1985, 1987), Wärneryd (1988), Chell et al. (1991), Cooper and Gimeno-Gascon (1992), Furnham (1992), Brandstätter (1997), Rauch and Frese (2000), Mueller and Gappisch (2005). In the economic science, Kihlstrom and Laffont (1979) as well as Holmes and Schmitz (1990) made important contributions relating to the variables of risk taking propensity and need for achievement.

(1999), and between successful and unsuccessful entrepreneurs by McClelland (1987) and Goebel and Frese (1999). Within the present analysis, the variable “need for achievement” will be measured in two ways, by making use of Test 1 of the questionnaire and by the psychological evaluation based on the observations during the AC.

“Locus of control” (drawing back on a concept of Rotter, 1966, and Furnham, 1986) measures generalised expectations for 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 behaviour does not have any impact on their future outcome, 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 by non-routine tasks. It enables an individual to understand and solve given problems by transferring knowledge into specific actions (see also Conrad et al., 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 of approaching other people and of developing 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. First empirical evidence on this relation is found by Baron (2000). We will analyze this variable by making use of the categorical variable “assertive-

ness/interpersonal reactivity” which was extracted from the psychological evaluation during the AC.

The final variable, “assertiveness”, expresses the ability of getting through with one’s interest in a socially acceptable way. Insofar, this variable is 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 (not extremely!) high⁸, the entrepreneur will be better able to realise the planned profits. Also with respect to this variable, empirical studies revealed significant differences between entrepreneurs and managers (cf. King, 1985; Chell et al., 1991; Müller, 1999). Within the present framework, the variable “assertiveness” is analysed by making use of Test 4 of the questionnaire. Moreover, as psychological research relates the variable “assertiveness” to “interpersonal reactivity”, both variables were measured during the psychological evaluation by making use of one categorical variable (which combines assertiveness and interpersonal reactivity).⁹

Table 1 displays which traits were used in the present analysis, which previous empirical findings exist and which measurement methods were applied. All 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 in particular these variables are so crucial for entrepreneurial success. According to this model it is expected that these specific traits have a stronger impact on the planning of a business and on the choices of strategies and actions during the business formation, which again determine the later success of an entrepreneur.¹⁰ Our overview of the existing empirical analyses showed that there are ex-post significant differences between entrepreneurs and managers and between successful and unsuccessful

⁸Winslow and Solomon (1987) defined the optimal level of assertiveness as “mildly sociopathic”.

⁹In this context it should be highlighted that there is (next to these five) one further variable, “risk attitudes”, which is deemed to be crucial for the development of a business. Chell et al. (1991) as well as Klandt (1996) assert that it would be wrong, however, 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 of a business opportunity should therefore be of medium range. Empirical research also found that risk attitudes have a negative effect on success beyond a certain point (cf. Begley and Boyd, 1987). Moreover, in recent research it was shown that the decision to become an entrepreneur is positively related to risk attitudes, however, only if the business founder starts out of a regular employment (cf. Caliendo et al., 2006a). 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 observed person is also the source of action (for more details on the “Giessen-Amsterdam Model”, cf. Rauch and Frese, 2000).

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. AC and Test 1	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 Gyskiewicz (1993), Müller (1999b)	Psych. AC and Test 3	positive
Interpersonal Reactivity Assertiveness	Baron (2000) King (1985), Chell et al. (1991), Müller (1999b)	Psych. AC Psych. AC and Test 4	positive positive

Note:

entrepreneurs with respect to these variables.¹¹

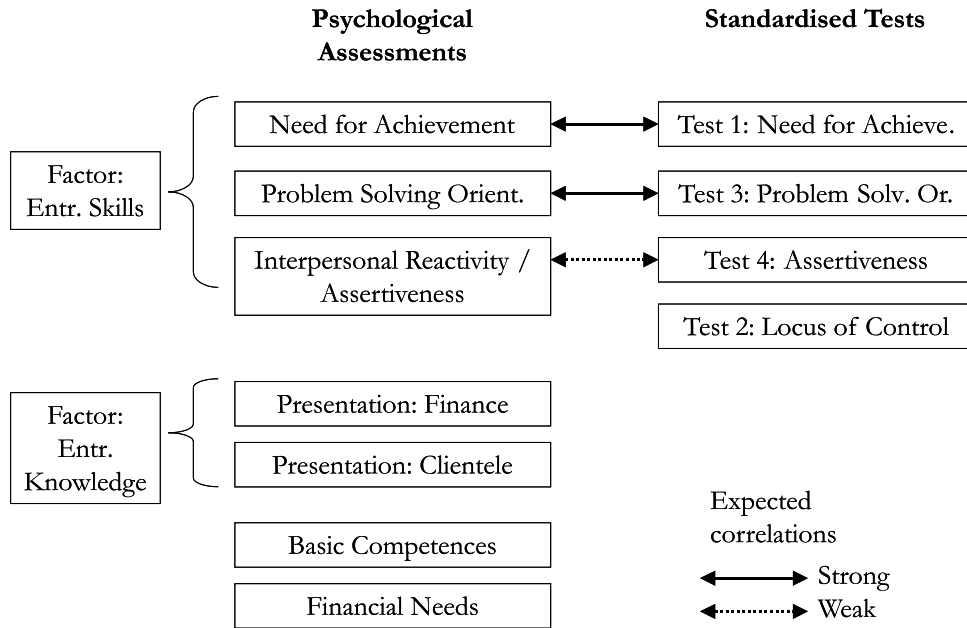
Based on the theoretical approaches and on the previous empirical findings, we are able to test in **hypothesis 1**, that, if properly assessed, business-founders should have a higher probability of becoming a successful entrepreneur, the

- higher their “achievement motivation” is,
- stronger their internal “locus of control” is,
- better their “problem solving orientation” is, and
- higher their “assertiveness” in combination with their “interpersonal reactivity” is.

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

¹¹Moreover, there is one study explicitly testing whether other more general variables do also have predictive power: Baum (1995) found, that the five variables mentioned before are stronger related to entrepreneurial success than more general variables (such as those which are used for instance in the famous so called “Big Five”-test.)

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



In this research, also some emphasis was put on the limits of this approach. On the one hand, the size of the firm in terms of hired employees is often highlighted as of being fundamental for the application of the model. The impact of the personality of a firm’s owner on its later success should be higher, the less employees a firm has.¹²

On the other hand, there is no common position about the impact of personality characteristics on entrepreneurial success. Some approaches suggest that these traits should be used to predict the development of an individual as entrepreneur (see, e.g., Müller, 1999). As there are many personality variables possibly influencing entrepreneurial success, a second expectation is that there will be no high correlations between each single variable and entrepreneurial success (cf., e.g., Rauch and Frese, 2000). Others believe that there will be no correlations between traits and success of an entrepreneur, at all, because “the diversity among entrepreneurs is much larger than differences between entrepreneurs and non-entrepreneurs” (cf. Gartner, 1988).

It is, therefore, further suggested to test for correlations between all variables and, if the variables are sufficiently correlated, to extract factors which allow to analyze more general trait dimensions of entrepreneurial personalities (see e.g. Robinson et al., 1991; Miner, 2000; Rauch and Frese, 2000; Mueller and Gappisch, 2005). Such approaches

¹²Rauch and Frese (2000) guess that the personal traits of a firm owner should have an impact if there are less than ten employees in the firm.

also relate to the more parsimonious trait typologies which were used in the economic sciences, as for instance by Lucas (1978) who focuses on entrepreneurial talent or by Holmes and Schmitz (1990) who define entrepreneurial abilities as of being the crucial trait to differentiate 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 out of these variables. Under the condition that we are able to do so, we will state in **hypothesis 3** that a business founder should have a higher probability of entrepreneurial success the higher the factors are which are extracted from the traits variables.

3.2 Human Capital and Entrepreneurship

Human capital theories relate in a similar way to entrepreneurial success as the personality of a human being: Sufficient knowledge and working experience in the relevant fields enable business founders to choose more efficient actions for instance in terms of organizing processes, creating financial strategies for the venture or analyzing the related markets of the newly developed product. Besides the entrepreneurial personality, the human capital of an entrepreneur is the second part of the character-based approach.

Most theoretical studies analyzing the impact of human capital on the success probability of a new venture are concerned either with the general human capital (such as the years of schooling or working experience), with various kinds of specific human capital (such as experiences 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) showed that it is important for the later success if business founders have developed a broad basis of knowledge instead of having been specialized to a certain topic.

Relations between several variables of the human capital approach and the success rates of entrepreneurs were empirically tested, as well: Chandler and Hanks (1994, 1996) showed that there is a positive impact if persons found their businesses in the same branch where they gathered previous working experiences. The same authors observed only a weak impact of general human capital on the success rates in terms of years of schooling. A good explanation for the latter result is given by Lazear (2004) and Wagner (2003) who found empirical support for Lazear's "Jack of all trades model" which is not necessarily

correlated with the 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 was 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 monitor whether founders have working experience in the branch of the planned business (basic competencies). 2) From the set of specific human capital variables, it was 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.

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 changes, for instance through training, seminars and coaching. Therefore, we formulate as **hypothesis 4** that the level of human capital observed before the start-up of 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 passed the above-described AC and founded their own firm in the business incubator in Hamburg. The participants launched their businesses between 2001 and beginning of 2004. In order to assure that there is no heterogeneity regarding the support of the individuals, we restrict our analysis to applicants who made use of the same kind of incubator service which is shortly mentioned in Section 2.

In addition to the data from the assessment centre, we collected information which records the actual performance of these persons. The aim was to identify how many business founders are still self-employed, took in the meantime a position as salaried employee or became unemployed. Founders who have started their own business were

Table 2: Description of the Variables and Summary Statistics

Variables	Age			Gender	
	All	< 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	–	–
Standardised Test (Measure of the applicant's ...)					
1. Need for achievement	3.99	3.97	3.97	3.88	4.17
2. Locus of control	3.22	3.20	3.20	3.20	3.24
3. Problem solving orientation	3.67	3.54	3.54	3.66	3.70
4. Assertiveness	1.82	1.74	1.74	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

also asked whether they employ other persons. The data for this analysis was gathered through telephone interviews carried out in the first quarter of 2005.

Table 2 contains some summary statistics of the available variables, which we will describe in Section 4.1. The first column refers to the whole sample of participants, whereas columns 2 through 5 differentiate the sample by age and gender which allows to test for differing effects in these four subgroups. One shortcoming of the data is that we do not know the actual age of the individuals, but 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.¹³

After a short overview over the descriptives of the data, we will start the empirical analysis in Section 4.2 with an examination of the standardised test variables and of the assessment conducted by the psychologists. Thereby, 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 which are the employment status and the number of employed persons in the newly found business.

4.1 Set of Variables and Some Descriptives

Table 2 provides an overview and some summary statistics of the available information. We will briefly discuss each variable and its distribution in the data. We start with the standardised tests as 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 measures the applicant’s “achievement motivation”, the second aims to show to what extent the applicant disposes of an “internal locus of control”, whereas the third test reflects the applicant’s “problem-solving orientation”. Finally, 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 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 of two psychologists (who were supported by two laypersons) on different scales while they observed the performance of the applicants during the presentation of their business ideas and during the exercises.

The first block of variables analysed during the AC relates to the status quo of the business specific human capital of the founders. “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 roughly 2.1. “Presentation: clientele” is scaled on the same choice set as presentation finance and the average assessment is 1.94 here. However, young people score worse than average (while

¹³For more details on these data, see Caliendo et al. (2006b).

older do better). “Financial needs” is scaled as 0(=no) or 1(=yes), where 41 percent of all applicants knew how to finance the business concept during the following years and the rate for women is lower at 35 percent.

The second block of variables analysed during the AC is concerned with the traits of the applicants, in particular with: 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 was 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), of 2 reflects weak assertiveness and strong interpersonal reactivity (36%), of 3 strong assertiveness and weak interpersonal reactivity (27%), and of 4 well-balanced assertiveness and interpersonal reactivity (12%). It is interesting to note that younger people score higher on the variable interpersonal reactivity and older persons on assertiveness.

4.2 Correlation Analysis - Standardised Tests versus Psychological Assessments

Table 3 contains pairwise correlation coefficients of the four standardised 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 variables 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 for the questionnaire data that tests 1 and 4 are negatively correlated.

Therefore, similar to earlier research we extracted a factor labelled “entrepreneurial skills” from the variables “achievement motivation”, “assertiveness/interpersonal reactivity”, and “problem-solving orientation”. We were able, as well, to extract a second factor “entrepreneurial knowledge” from the variables “presentation: clientele” and “presenta-

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.

tion: finance” (see also Figure 1). Since the same holds true for the standardised 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).

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 standardised test variables 1, 2 and 3, though on a low level of around 0.09. Thus, as the third test should measure the problem-solving orientation of the individual, 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 (Age below/above 30) in the Appendix) we found more mixed results: For individuals older than 30 years we find the most positive correlations, namely for two combinations “Test 1 and Achievement Motivation” as well as for “Test 4 and Assertiveness”. Most curious, for people younger than 30 years the same (and some further) combinations are negatively correlated. The differentiation by gender shows no further insights.

Result I: (1) The high correlations within each of the two assessment methods allows extraction of two factors out of the variables gathered during the assessment centre,

namely “entrepreneurial skills” and “entrepreneurial knowledge”. Due to the high correlations within the questionnaire, a cluster analysis on the test scores will be conducted, as well. (2) There is no support for Hypothesis 2, correlations between the two methods of measuring personality variables: For the complete sample there are no significant correlations. Only for the subgroup of older persons there are some positive while for younger persons there are even negative correlations. Hence, in general, standardized tests and psychological assessments seem to measure parameter values which are independent of each other.

4.3 Analyzing the Success of the Start-Ups

We analyse 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 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 which we want to analyse relates to the success of the entrepreneur in terms of hired employees. Therefore we construct an outcome variable which takes on the value 1 if the self-employed 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 both outcome variables we employ five sets of explanatory variables X . In the first specification we only exploit the standardised test scores, whereas in the second specification

we exclusively use the psychological assessments. Specification three combines both sets of explanatory variables, whereas in specification 4 we implement the reduced variables from the factor and cluster analysis. Finally, in specification five we include the reduced variables from specification 4 and add two more explanatory variables concerning the entrepreneurial knowledge. Table 4 summarises the strategy.

Table 4: Overview of the Different Specifications

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

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 contains the estimation results of the multinomial logit model for the whole sample and Table A.3 in the Appendix shows which coefficients have been significant for the four subgroups.¹⁴ The coefficients have to be interpreted in relation to the base-category, which is unemployment in our case. That means, that a positive coefficient in the upper half of the table indicates, that a variable has a positive influence on the probability to be in self-employment (compared to unemployment). The results in the lower part refer to the status regular employment.

¹⁴Full estimation results for the subgroups are available on request by the authors.

INSERT TABLE 5 ABOUT HERE

Table 5 shows that there is one variable ‘assertiveness’ among the four tests of the questionnaire which has a significant effect in specification 1. A higher score in this variable increases both the probability to be in self-employment and 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 of the questionnaire data which is significant in the female subgroup.¹⁵

Using only the psychological assessments in specification 2, we do not find any explanatory power for the model, i.e., for the complete sample none of the variables, which were generated by psychological assessment, is 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.¹⁶ The latter result is particularly interesting, as it shows 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.

Combining both sets of variables in specification 3 confirms the positive influence of the variable ‘assertiveness’ for the questionnaire data and reveals additionally a positive influence of the variable ‘problem-solving orientation’ for the psychological assessment.

Result II: We found partial support for hypothesis 1. (1) Among the five variables discussed in the previous section, ‘assertiveness’ had in all four subgroups a significant impact on entrepreneurial success, however only when two screening methods are applied in a complementary way. Furthermore, ‘Problem solving orientation’ was significant for two subgroups when the psychological assessment is applied and ‘need for achievement’ for one subgroup when the questionnaire is used.

We have shown in section 4.2, that the variables collected by psychological assessment are highly correlated between each other. Therefore, we use a factor analysis to condense the information to two factors ‘entrepreneurial skills’ and ‘entrepreneurial knowledge’. Furthermore, as mentioned above we were also able to make a cluster analysis of the questionnaire data. The results of the further analysis are presented in Specification 4

¹⁵Additionally, men and older individuals have a higher probability to be in regular employment.

¹⁶Older individuals have now a significant lower probability to be in self-employment and regular employment.

showing that the 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 showed not to be significant). As to the subgroups, we find that the correlation ‘entrepreneurial skills’ with self-employment holds only for the same subgroups as the variable ‘assertiveness’, that is for men and for older persons. In contrast to this, the cluster variable of the test scores which is based on the questionnaire remains insignificant for all specifications and in all subgroups.

Result III: (1) In favour of hypothesis 3 the factor ‘entrepreneurial skills’ has some predictive power for the model. (2) The test scores of the questionnaire data have no predictive power.

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 the later development as an entrepreneur. 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 competences) has any significant impact. Similarly the factor ‘entrepreneurial knowledge’ extracted from the two presentation variables showed to be insignificant.¹⁷

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

Result IV: (1) In support of hypothesis 4, variables relating to the specific human capital which is needed to run an own business as well as the factor “entrepreneurial knowledge” have no predictive power on entrepreneurial success.

The last finding needs some further discussion: In particular, the negative significance of the factor entrepreneurial knowledge on self-employment, observed for the male sub-

¹⁷Interestingly, high levels of entrepreneurial knowledge previous to the start-up of the own business significantly increased the probability to return later on into regular employment but had no impact on self-employment. It seems that other firm owners also have an interest into such specific knowledge.

group, does not allow for the conclusion that male founders will be more successful as entrepreneurs the less they know. It should be reminded that these persons started their business in an incubator being able to participate in an intensive training and coaching. Therefore, this observation rather indicates that such training might be apt to compensate missing knowledge before the business was found.

At the end of our empirical analysis, we will return to one important question which was shortly mentioned in the beginning of this paper: the size of the firm in terms of hired employees and the impact of personality characteristics on the firm size. Generally speaking, entrepreneurship research believes that we deal only with real entrepreneurship when the owner of a firm has hired at least one employee. Firm owners without any further employees are distinguished from entrepreneurs - being classified for instance as small business owners or 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 shortly before they started to run their own business and where many of them had not yet planned whether they will employ further persons. Therefore, when it comes to the size of a firm, we are able to make an analysis of our data without normative distinction within the population of self-employed persons.

We analyze, thus, the success of the start-ups in terms of the number of hired employees. The descriptives in Table 2 showed, that in our sample roughly 30% of the former incubator clients have at least one employee at the time of the interview.¹⁸ Table 6 contains the results for the same five specifications we discussed earlier in this section. The coefficients have now to be interpreted in the sense that entrepreneurs with at least one employee are compared with the base-category which is in this case self-employed without further employees.

INSERT TABLE 6 ABOUT HERE

Interestingly, Table 6 shows that neither the variables derived out of 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

¹⁸This corresponds to the overall share of previously unemployed entrepreneurs employing further persons in their own business. For more details, see Caliendo et al. (2006b).

between entrepreneurs with and without further employees. Overall, the level of entrepreneurial skills and knowledge of founders measured before their businesses were launched seem to be the same, irrespective of the later size of the firm measured in terms of further employees.

Result V: (1) None of the assessment methods finds significant differences in the character-based approach between those entrepreneurs who employ further persons and those who run their business all by themselves.

This result makes clear that other personality traits than those considered here might drive the decision to employ further persons, once a firm has been found. As the prerequisites to lead other persons rather refer to traits known from managerial skills (see, e.g., Miner, 1997), we may conclude that the character-based approach - as considered here - is not apt to make any prediction whether a fairly well skilled entrepreneur will run the business all by himself or whether he or she will employ further persons in the firm.

Before we come to the conclusion, we should highlight one very final result which showed 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 without additional employees. This result tells us that younger persons have a higher probability i) to remain self-employed once they made this decision and ii) to employ further persons when they are self-employed. They also have a higher probability iii) to return into regular employment when they stop to be self-employed for whatever reasons.

5 Conclusions

The aim of this study is to investigate the predictive power of the character-based approach. For that we collected information from those personality traits of potential business founders which are (said to be) crucial for later entrepreneurial success. We analyzed to what extent this information allows predictions of entrepreneurial development. Furthermore, we are - for the first time - able to investigate the impact of different methods collecting such information which were applied at the same time before the potential business founders started their business.

Psychological research has identified a set of variables which have to fulfil two necessary conditions to be good for prediction: the identified variables have to be i) crucial for the development as an entrepreneur and ii) stable over time. Among the set of entrepreneurial personality traits we were able to collect data for the following variables: “need for achievement”, “locus of control”, “problem-solving orientation”, “assertiveness” and “interpersonal reactivity”. The information on most of these variables was revealed by two screening methods: on the one hand, potential founders were asked to fill in a close ended questionnaire where the selected answers allowed to draw conclusions about the realisation of these variables. On the other hand, the same persons participated in a one-day assessment centre (AC). In this AC they were given certain exercises and trained psychologists were able to observe which parameter values each participant had developed with respect to the just mentioned personality characteristics.

During the same AC, we were also able to collect information about the status quo of the specific entrepreneurial knowledge of business founder and to test whether the status quo such specific human capital before the start-up of the business had any predictive power. Finally, the high correlations between the variables observed during the AC allowed us to extract two factors - “entrepreneurial skills” and “entrepreneurial knowledge” - and to make a cluster analysis of the test scores of the questionnaire data.

In order to evaluate the impact of all variables and factors on the development of a business-founder we briefly interviewed 414 persons who passed these assessment methods and started their business in one and the same business incubator in Hamburg. Our expectations were that the probability of being still self-employed will be correlated with positive scores in each of the variables related to traits, with the cluster variable of the test scores and with the factor “entrepreneurial skills”. With respect to variables and the extracted factor concerning entrepreneurial knowledge, we expected no correlations.

Results are partly surprising: First of all, there is no significant correlation between the questionnaire and the psychological assessment. Second, among the observed variables (of the psychological assessment) we found a significant correlation between the factor “entrepreneurial skills” and the later success as an entrepreneur but for almost no single personality trait. Third, as for the test scores the opposite is true: here the cluster analysis of the test scores was insignificant, but the variable “assertiveness” showed to have a positive impact. Fourth, previous research had found in particular that the vari-

ables “need for achievement” and “locus of control” showed to be positively correlated with entrepreneurial success. Our analysis found no such correlation, at all. Instead, we revealed that the variable “assertiveness” had such an impact in all four subgroups, however only after having made simultaneous use of both assessment methods. Fifth, entrepreneurial knowledge had no impact on the self-employment status. This observation is less surprising, as the participants had gone through an intensive training after the assessment. In this respect, it seems more interesting 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 which allow to combine entrepreneurial knowledge with given traits.

There are some more results which should be highlighted. Persons who started an own business but later on 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 to those persons who are still running their own business only insofar as the employees took higher values with respect to the variables on entrepreneurial knowledge. More importantly, for the subgroup of the entrepreneurs who employed further persons in their firm (those who are deemed to be the ‘real entrepreneurs’) both assessment methods found no significant differences when this subgroup was compared to entrepreneurs working all by themselves. This finding has two consequences: on the one hand, it seems that the level of entrepreneurial knowledge and skills has no impact on the decision whether the owner of the firm will employ further persons or not. On the hand, as the above discussed variables are supposed to be crucial for being an entrepreneur, entrepreneurship research in all relevant sciences has to re-evaluate the often suggested differentiation between “real entrepreneurs” (who employ further persons) and small business owners without further employees. The present analysis reveals that these two groups cannot be differentiated with respect to their personality characteristics, at least when these were observed before businesses were launched.

These findings allow drawing some conclusions: The predictive power of a specifically designed assessment centre is only slightly better than of the questionnaire. Moreover, this study makes clear that it might be useful to combine both methods - psychological assessment by well trained third persons and self-evaluation via a validated questionnaire

- and to make use of the so gathered information only in order to improve decision making processes as to whether a certain person should become an entrepreneur. However, a mere success prediction based only on one day of observing a person who is participating in an assessment centre is not (yet) possible. Further, for potential founders who aim to open up a larger business it seems that further skills than the observed ones are also crucial.

The results of both methods remain under the expectations raised by entrepreneurship theory. At the same time, when we put both screening methods together, we will probably have a better prediction of entrepreneurial success than by any existing scoring model used so far by banks who are working in the field of small business finance. Of course this assertion has to be verified in the future. However, to the best of our knowledge, we do not know of any scoring model which had produced any significant correlations between any of the variables used in such scoring models and the later success of an entrepreneur.

From a more general point of view, our analysis still leaves open whether entrepreneurship research has identified the right variables to capture entrepreneurial behavior, whether the observed variables are indeed stable over time, whether intensive support measures like an incubator service have an impact even on personal traits, or whether only the methods of assessing the potential entrepreneurs need to be improved. On another note, further measurements of entrepreneurial success besides the ones we used here have to be developed. To this end additional research is needed.

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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+
Standardised 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 Competences					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*
Standardised 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 Competences					-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
Standardised 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)					
Weak assertiveness and strong interpersonal reactivity		-0.041	-0.082		
Strong assertiveness and weak interpersonal reactivity		0.009	-0.103		
Equally assertive and interpersonal reactive		-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 Competences					-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 %.

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*	0.312*	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
Standardised 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 Competences	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
Standardised 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 Competences	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