Chapter 2
A Psychology-Enabled Solution to Small- and Medium-Sized Enterprise Finance

Abstract Industrial and Organizational Psychology has developed tools to solve a similar problem: personnel selection. Big companies need to select among a large number of individuals applying for a job. This has to be done with relatively low transaction costs, and there is little information available to separate the good candidates from the bad candidates—a very similar problem to that facing the banks. Psychologists have developed psychometric tools to measure things like personality, motivation, outlook, and intelligence, which are related to subsequent job performance. These tools have been shown to work even better than other methods like interviews and background checks, and are widely used. What if they could be applied to the selection of small businesses to lend to? We review a variety of academic studies that have already used these tools to evaluate entrepreneurs and distinguish entrepreneurs from non-entrepreneurs and good entrepreneurs from bad entrepreneurs. The studies center on three main themes: personality, intelligence, and honesty. The first two relate to the ability to repay a loan, in that they could identify entrepreneurs who are more likely to successfully grow their business and its cash flows. Honesty relates to the willingness to repay a loan, as banks need to worry not just if the entrepreneur has enough money to repay but if they then decide to repay or else take the money and run. These studies provide initial insight into what particular characteristics and abilities could be systematically related to credit risk, and used for future lending to small business owners who would traditionally be rejected by banks due to a lack of information.

Industrial and organizational psychology has been working on a problem very similar to the challenge facing banks wanting to lend to small- and medium-sized enterprises in emerging markets. That problem is selection in human resources. Firms must decide which individuals to hire, based on little available information. Moreover, particularly for entry-level positions, firms must evaluate a large number of applicants in a low-cost way. To solve this problem of little information to evaluate individuals, and the inability to bear large transaction costs in that evaluation, is

B. Klinger et al., *Enterprising Psychometrics and Poverty Reduction*,
SpringerBriefs in Psychology: SpringerBriefs in Innovations in Poverty Reduction,
DOI 10.1007/978-1-4614-7227-8_2, © The Authors 2013

quite similar to the problem facing small- and medium-sized enterprise lenders in emerging markets. And to help solve this problem, industrial and organizational psychologists have developed a very large toolkit of tests. And it turns out that many of these tests have already been used to study the characteristics of successful entrepreneurs, finding a variety of robust relationships. These tools and results will be briefly reviewed here.

Psychometric Tools for Employment Selection

Personnel selection is a well-developed field in industrial and organizational psychology and is of immense economic importance to companies that must select and develop employees. Due to this importance, assessments for personnel selection have a long and deep history, going back a millennia, and evaluations of those assessments going back a century (Schmidt and Hunter 1998). This research has considered a variety of assessment types, including psychometric assessments of personality, integrity, and intellectual ability. Though there are debates, overall the results show a highly valuable contribution of these tools to the personnel selection process.

Schmidt and Hunter (1998) perform a major meta-analysis of these studies. Their results show that general intelligence tests, integrity tests, and personality tests are (along with work sample tests) the selection methods with the strongest ability to predict overall job performance. These tests beat out employment interviews, peer ratings, and reference checks, as well as biographical data, job experience, and level of education (which are also typically used in credit-scoring models). The relationships are statistically significant, particularly when they match the competencies required to do the job, and they are surprisingly persistent: Judge et al. (1999) show intelligence and personality are predictive of career success throughout one's entire professional life, until retirement, and even when measured at childhood.

Their perceived value is also evidenced by their widespread use by companies. According to a 2001 survey by the American Management Association, 41 % of employers test job applicants, including 20 % using cognitive ability tests and 13 % using personality tests (American Management Association 2001). A more recent survey found that between 2002 and 2007, the use of personality assessments for selection went from 21 % to 59 % of surveyed employers, the use of cognitive ability tests went from 26 % to 41 %, and the use of more general skills/knowledge tests went from 12 % to 56 % (Handler 2008). There are over 2,500 companies in the United States successfully developing and selling these psychometric tests for employee selection, and demand continues to rise.

Psychometric tools seem to be quite valuable then for personnel selection. Perhaps these same sets of tools could be applied to the evaluation of the quality of entrepreneurs and to boost confidence by banks to take a risk by lending to them. There is reason to believe so, as there is a long literature examining the psychometric characteristics of successful entrepreneurs, many using the same assessments that are applied to personnel selection.

Psychometric Studies of Entrepreneurship

There is a long history of research on entrepreneurs and entrepreneurship, including many studies examining how entrepreneurs differ from non-entrepreneurs or how good entrepreneurs differ from bad entrepreneurs. Much of this work uses psychometric assessments to try and measure these differences.

One of the earliest examples is D. McClelland's (1961) seminal work, suggesting that the psychological "need for achievement" *(or nAch)* is the key driver of entrepreneurial behavior among individuals. This was but the first of thousands of studies over the past 50 years examining what characteristics and traits are related to entrepreneurial outcomes. For a detailed review of this literature, see Chell (2008).

A valuable meta-analysis is provided by Rauch and Frese (2007). This study combined the results of 116 independent samples yielding a sample size of 26,700. The authors found consistent and moderate relationships between various psychometrically measured traits and entrepreneurial outcomes. Their desire to "put the person back into entrepreneurship research" is not without its skeptics, who view the trait approach to the study of entrepreneurship as flawed (e.g., Gartner 1989; Shaver 1995). The majority of these studies examine either the likelihood of business creation (in other words, the differences between entrepreneurs and non-entrepreneurs) or the likelihood of business success (in other words, the differences between good entrepreneurs and bad entrepreneurs). It is difficult to specify the outcome variable and comparison groups in these studies, which is a major shortcoming in the literature (Shaver 2007). As will be discussed further below, this is one of the advantages of the present study, which has very clear and cleanly defined outcome variables and comparison groups: defaulters versus non-defaulters and high-profit versus low-profit small business owners.

For the present study, we will focus on psychometric assessments across three broad themes that have established findings in both the personnel selection and entrepreneurship literature: personality, integrity, and intelligence.

Personality

Distinguishing personality characteristics of entrepreneurs are the most traditionally studied of these three themes, going back to the work of McClelland (1961). The same holds true for descriptions of the distinguishing characteristics of successful entrepreneurs in the popular press and society in general. When talking about how entrepreneurs are different, the most commonly heard characteristics relate to personality, such as differences in drive, motivation, creativity, persistence, and risk taking. In the study of personality, the five-factor or "Big Five" personality model of Openness to new experience, Conscientiousness, Extraversion, Agreeableness and Neuroticism/emotional stability (Barrick and Mount 1991) is the dominant model, and it has been used in the study of entrepreneurs in a number of works.

Holland (1985) described an Entrepreneurial type (E-type) in his RIASEC vocational personality model (In Holland's model, the acrostic "RIASEC" stands for Realistic, Investigative, Artistic, Social, Enterprising and Conventional). This is a typology, meaning that not all E-types become successful entrepreneurs, yet the E-type traits will be displayed by most entrepreneurs. In the Big Five model (above), this E-type has been related to higher Conscientiousness and Extraversion and lower Agreeableness and Neuroticism, without differences in Openness (Gottfredson et al. 1993).

The empirical work on entrepreneurship and the Big Five is most completely reviewed in Zhao and Seibert (2006), who perform a systematic meta-analysis on the Big Five and entrepreneurial status. Entrepreneurial status is the selection of an individual into an entrepreneurial career, typically as opposed to a management career. The factors related to selection into entrepreneurship could be quite different from those related to success once one has engaged in an entrepreneurial venture. However, the studies examined in this meta-analysis test current entrepreneurs against managers, and therefore the pool of entrepreneurs has at least achieved sufficient success in entrepreneurship in order to start a venture and survive long enough to be tested the study. Therefore, entrepreneurial selection necessarily includes at least some element of success in entrepreneurship.

Zhao and Seibert (2006) provide both literature review and arguments to advance the following hypothesized relationships: Entrepreneurs will score lower than managers on Neuroticism and Agreeableness. Entrepreneurs will score higher than managers on Extraversion, Openness, and Conscientiousness, and within Conscientiousness, both achievement motivation and dependability will be higher for entrepreneurs than managers, but potentially to different degrees.

The results of Zhao and Seibert (2006)'s meta-analysis found support for the hypothesis that entrepreneurs scored lower than managers on Neuroticism and Agreeableness and that entrepreneurs scored higher than managers on Openness and Conscientiousness (which had the largest effect). There was not conclusive evidence on differences in the relationship of Extraversion to entrepreneurial status (defined as the probability of being the founder, owner, and manager of a small business whose principal purpose is growth, as opposed to a salaried manager in a business). Within Conscientiousness domain, the authors found that the sub-facet with the strongest relationship to entrepreneurial status is *n*Ach. Entrepreneurs had significantly higher *n*Ach than managers, but both groups were indistinguishable in terms of the dependability sub-facet in the Conscientiousness domain. Interestingly, the authors also considered the hypothesis that the relationships of two of the Big Five (Neuroticism and achievement motivation) were moderated by national cultural dimensions of uncertainty avoidance (need for structure, certainty, rules) and performance orientation, respectively, but found no supporting evidence for this hypothesis, supporting the possibility that these tools could be used for selection across different cultures or at least the range of cultures sampled in the literature that was reviewed in the meta-analysis.

In addition to examining the direction of the relationship with individual traits, Zhao and Seibert (2006) examined the overall predictive power of the Big Five

personality traits to entrepreneurial status and found an adjusted R-squared of 0.37. This is moderate in the social sciences when attempting to fully explain phenomenon, but in terms of predictive power typically used for selection and credit scoring, this is a relatively strong result, explaining a portion of the variance that could allow for major risk splitting power if anything near this R-squared could be achieved in predicting default.

This highlights one of the weaknesses of the bulk of studies on entrepreneurship and personality that Zhao and Seibert review: the focus on selection into entrepreneurship rather than success at entrepreneurship. They are somewhat related, but from the point of view of resolving the barriers in small- and medium-sized enterprise access to finance highlighted above, we must extend these results to more appropriate prospective rather than concurrent outcomes.

Ciavarella et al. (2004) take one step further in this prospective direction by examining long-term venture survival rather than entrepreneurial status at various stages as in the literature reviewed by Zhao and Seibert (2006). Ciavarella et al. (2004) examine both the probability that the entrepreneurial venture will survive for at least 8 years, as well as the overall lifespan of the entrepreneurial venture, as their outcome variables, within a sample of United States college students followed over the span of their careers. Their hypothesized relationships are that Extraversion, Agreeableness, Conscientiousness, and Openness will be positively related to venture survival while Neuroticism will be negatively related. Interestingly, their hypothesis on the relationship with Agreeableness is in the opposite direction of that in Zhao and Seibert (2006) and Holland's E-type (1985). The authors argue for this relationship based on the link between Agreeableness and ability to cooperate effectively (Judge et al. 1999) which in turn has been listed as a key factor in entrepreneurs' ability to secure capital (Cable and Shane 1997) and partner with suppliers.

The results of Ciavarella et al. (2004) found support for the positive relationship between Conscientiousness and venture survival and found a weakly negative relationship between Openness and venture survival. The other Big Five traits did not have significant relationships with venture survival. It is important to note however that the study had a small sample size compared to Zhao and Seibert (2006), with only 111 entrepreneurs.

Ciaverella et al. (2004) suggest that one of the reasons for the negative relationship with openness (that contradicts prior studies) may be that those with higher openness are more likely to select into entrepreneurial careers but conditional on that, may be less likely to succeed, highlighting the need for better outcome variables in the study of entrepreneurial *outcomes*. The authors call for this explicitly: "further studies should examine the effects of the Big Five personality variables on other measures of performance, such as sales and/or employee growth, profitability measures, and effects on stakeholders" (p. 481).

For similar reasons as those used by these authors, we use a personality assessment based on the five-factor model, provided by a leading test provider for professional industrial and organizational psychologists.

Intelligence

Popular literature on entrepreneurs typically refers to psychological characteristics such as drive, motivation, and risk taking but does not as often comment on intelligence. Success in entrepreneurship is not necessarily correlated with academic achievement, as evidenced by high-profile university dropouts like Mark Zuckerberg and Bill Gates, though more systematic studies of the subject do find links between education and entrepreneurial outcomes (De Mel et al. 2008). Educational attainment though is not necessarily related to intelligence, particularly in emerging markets where access to education can be driven largely by socioeconomic status. We therefore examine both educational attainment and two popular tests of intelligence.

The first test is of digit span recall, a component of the Wechsler Adult Intelligence Scale (WAIS-III), probably the most widely used intelligence test worldwide. The test taker is shown a string of digits for 5 s, the string is then hidden for 5 s, and then the test taker must enter the number. If they do so correctly, the subsequent number is one digit longer, and the test continues until a mistake is made. The same is then repeated, but the test taker must enter the number in reverse.

Economists studying the links between individual-level differences and entrepreneurial outcomes have been using the digit span recall test with increasing regularity, first Djankov et al. (2005), who found that in a random survey of Russian entrepreneurs and non-entrepreneurs, entrepreneurs scored significantly higher on the digit span recall test, and this was one of the strongest individual-level differences between the two groups. This finding was subsequently repeated in Brazil (Djankov et al. 2007) but was not found to hold in the People's Republic of China (Djankov et al. 2007).

The same digit span recall exercise was subsequently used by De Mel et al. (2008) in the previously mentioned returns to capital experiment. In that experiment as we saw above, the authors found very high returns to capital for randomly-selected entrepreneurs, 5.7 % per month on average (68 % per year). Moreover, they found that these returns varied between individuals to the greatest degree by intelligence. Those that scored only 4 on the digit span recall test (bottom 15 %) had negative returns to capital, while the median scorers (6 digits) earned on average 4.8 % per month and those who scored 8 or more (top 11 % of test takers) had returns of 13.6 % per month. Such a test could therefore potentially serve as one indicator to help identify higher-potential entrepreneurs.

Digit span recall tests attention and recall but is not often used alone as a test of the broader construct of "intelligence." We therefore apply an additional test, the Ravens Progressive Matrices. This classic nonverbal test contains matrices of incomplete visual patterns, along with eight potential answers to correctly complete the pattern. This test has traditionally been considered to be "perhaps the best of all nonverbal tests" of general intelligence by Charles Spearman (1946), the creator of the construct. Recent evidence suggests that there may be an additional component of spatial/perceptual processing tested by the matrices, beyond generalized intelligence (Schweizer et al. 2007). Nonetheless, this test remains one of the oldest and most frequently used in the literature.

The Ravens Progressive Matrices have been used by other entrepreneurship researchers alongside the digit span recall test. For example, De Mel et al. (2010) conducting their research in Sri Lanka found that these two measures help to strongly distinguish entrepreneurs from waged workers. Moreover, the authors show that ability as measured by these two assessments can be used to distinguish what proportion of own-account (i.e., self-employed) workers are small- and medium-sized enterprise entrepreneurs whose businesses have yet to grow versus those that are self-employed out of necessity due to a lack of jobs and are more like salaried employees-in-waiting rather than entrepreneurs.

Continuing from these results, we deploy Ravens Progressive Matrices as a second test of intelligence alongside the digit span recall test. Ravens Progressive Matrices are used with permission from test owner Pearson Assessments.

Integrity

When speaking of lending, two drivers of risk are often distinguished: ability to pay and willingness to pay. The former refers to whether or not the borrower has enough cash to repay the loan—if they are ineffective entrepreneurs and their business does not generate enough cash to repay the loan, they will have to default or restructure the debt. However, there is also the risk that the borrower has sufficient cash to repay the loan but still chooses not to. This is known as strategic default, discussed frequently in the mortgage borrowing market after the 2008 financial crisis.

Past cash flows are difficult to establish and future cash flows are difficult to predict for small- and medium-sized enterprises. Therefore, psychometric measures that relate to entrepreneurial ability could clearly help predict entrepreneurs' future ability to generate cash flows from their business to repay loans, that is, their ability to repay. Yet psychometric instruments could *also* evaluate the other driver of risk, willingness to repay, through evaluations of honesty and integrity.

Honesty and integrity testing is very important in human resource contexts as well, where firms are keenly focused on losses due to employee theft and unethical behavior. This need has led industrial and organizational psychologists to develop a number of assessments of honesty and integrity. One such instrument was evaluated by Bernardin and Cooke (1993), who showed that an integrity assessment taken at the time of application for entry-level staff at a convenience store was a strong predictor of who was subsequently fired for on the job theft, explaining over 10 % of the variance. In general, integrity tests have been shown to relate to job performance, though recently a debate has emerged as to the strength of this relationship, as many impact studies are written by test vendors using unpublished data, rather than appearing in peer-reviewed journals (Van Iddekinge et al. 2012). Restricting attention only to the most rigorous of evaluations continues to show a relationship, though more moderate in strength.

While the relationship between integrity and job performance is established, the relationship between integrity and entrepreneurial outcomes has not yet been

systematically evaluated. Indeed, even the expected direction of the relationship is not intuitively clear. Are dishonest entrepreneurs more likely to fail at business because they cannot generate the trust needed for relationships? Or are honest entrepreneurs more likely to fail because they will be taken advantage of in the cut-throat marketplace? The theoretical relationship between integrity and entrepreneurial success could be in either direction.

To measure these relationships, we use an assessment that is a direct descendent of that used in the Bernardin and Cooke (1993) paper, which was shown to be predictive of which small business wageworkers were more likely to be subsequently fired from their jobs due to on-the-job theft. This assessment, originally written for wageworkers, was adapted to the context of small business owners.