Do Women Have a Less Entrepreneurial Personality?

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Abstract

A striking fact about entrepreneurship is that the number of male entrepreneurs greatly exceed the number of female ones. Using detailed survey data from Sweden, we study to what extent gender differences along personality traits can explain this gender gap. We show that women have markedly different psyche than men (11 out of 14 traits differ), and entrepreneurs have markedly different psyche than non-entrepreneurs (8 out of 14 traits differ). However, the gender differences in traits do not in a clear-cut way reduce women's likelihood of being an entrepreneur. On the one hand, women are less likely to be entrepreneurs because they are more risk avert, have weaker internal locus of control, are less tolerant of greed, and have a less favorable attitude towards civic engagements. On the other hand, women are more likely to be entrepreneurs because they are less ambiguity avert and less behaviorally inhibited. We find that, in aggregate, gender differences in personality traits explain a relatively modest part (our estimates suggest 21%-32%) of the gender gap in entrepreneurship. Most of the entrepreneurship gap is thus explained by something other than gender differences in psyche. In addition to drawing this conclusion, we show that entrepreneurial traits are generally *not* more prevalent for non-entrepreneur self-employed individuals, and gender differences in traits can explain much less of the gender gap in non-entrepreneurial self-employment. These latter findings highlight that entrepreneurship is distinct from other types of self-employment.

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1 Introduction and Literature Review

Gender differences in labor market outcomes are large and ubiquitous, especially for high-achieving jobs (Bertrand and Hallock, 2001). One controversial explanation for this disparity is that women may have "innate" personality traits that are not compatible with competitive, challenging and risky work environments (Gneezy, Niederle and Rustichini, 2003; Niederle and Vesterlund, 2007; Croson and Gneezy, 2009). While evidence from psychological tests and laboratory experiments confirm the existence of gender differences in traits, it remains an open question to what extent they explain actual employment choices.

In this paper, we study whether and how gender differences in personality traits explain gender differences in entrepreneurship. Around the world, the rate of male self-employment (the most common empiricaly proxy for entrepreneurship) exceeds that of females: in the US, 14% of the male labor force is self-employed versus 8% of women, and in the European Union, the corresponding figures are 19% and 10%.[1] From a policy perspective, it is important to understand the roots of this gender gap, because entrepreneurship carries considerable societal benefits—entrepreneurs innovate, launch products, create jobs and contribute to economic growth (Asc and Audretsch 1988, Kortum and Lerner, 2000, Carree and Thurik, 2003; Van Praag and Versloot, 2007). From an academic perspective, studying the reasons behind the gender gap can yield new insights on how to encourage, incentivize, and support entrepreneurs.

We build our analysis on the seminal argument by Frank Knight (1921) and Joseph Schumpeter (1934) that individuals who break new paths and undertake entrepreneurial ventures must have a special psyche. A large literature presents broad evidence in support of this argument, however, there exists little large-scale empirical research that directly links gender differences in personality traits to entrepreneurship[2]. It is challenging to establish such linkage because it requires data on a multitude of traits, for both entrepreneurs and other individuals. Overcoming this hurdle, we study gender differences in entrepreneurship using a recently-collected survey dataset from Sweden. Sweden presents a good testing ground for gender-based differences in labor market outcomes, because its high degree of emancipation diminishes the influence of institutional gender-based discrimination.

The scale and scope of our dataset gives us several research advantages. One, somewhat

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[1]The gender differences in self-employment exists in every EU country, and is greater for self-employed individuals who employ others (i.e., arguably a more relevant definition of entrepreneur).

[2]See Wagner (2007), Zhang et al. (2009), and Verheul et al (2011) for existing evidence.

unique, advantage is that we can distinguish between entrepreneurs and self-employed non-entrepreneurs. Whereas the former group strives to innovate and expand their business in a Schumpterian sense, the latter group may choose self-employment form because they receive non-pecuniary benefits from working for themselves (Hamilton, 2000; Hurst and Pugsley 2010), want to avoid taxes (Cullen and Gordon, 2007) or regulatory barriers to employment, or because self-employment reduces agency costs (Bitler et al. 2005). Although non-entrepreneurial self-employment plays an extraordinary important role for the economy, it is a distinct phenomenon from the entrepreneurship that policy makers and researchers have in mind. One contribution of our paper is to highlight this distinction by documenting that (i) only a third of all self-employed are entrepreneurs, (ii) the gender difference is greater for entrepreneurship than for self-employment, and (iii) the psyche of entrepreneurs is different from that of other self-employed individuals.

Another advantage is that our sample is large, with 7,331 unique individuals, and representative of the cross-section of the working Swedish population. All individuals in our sample are twins. Prior research has shown that twins are broadly similar to other individuals with regards to personality traits and economic behavior (Kendler et al 1995, Johnson et al 2002). The twin status makes it possible to include twin-pair fixed effects in regressions on how personality traits relate to entrepreneurship. We can thereby test whether each trait affects entrepreneurship through genetics and childhood experiences (which twins partly share), or has other explanations.

A final, and important advantage of our dataset is its unusual level of detail. Based on a multitude of survey questions, we identify 14 distinct personality traits that collectively capture key dimensions of an individual's psyche. These traits are risk aversion, loss aversion, ambiguity aversion, time discount rate (i.e., payoff patience), numeracy (i.e., ability to calculate odds), illusion of control, belief that money is fungible, awareness about the opportunity costs concept, tolerance of greed (i.e., acceptance of market economy outcomes that may be "unfair"), trust in others, locus of control, positive attitude towards civic engagement, behavioral inhibition, and happiness. Our survey data includes more questions per trait than as typical in similar studies that often rely on on indirect measures. For example, we measure of risk aversion on a series of question that are experimentally validated and shown to be predictive of real life risk taking behavior (Dohmen et al. 2011). Lastly, the richness of data allows us to compare the marginal influence on the likelihood of being an entrepreneur across traits that are empirically related, yet

conceptually distinct. For example, we can analyze separately the roles of behavioral inhibition and happiness, traits that are positively correlated with each other.

Our dataset also has two limitations. First, our sample includes only Swedes between the ages of 51 and 66. Due to the enormous data collection costs associated with the surveys, it is unfortunately not possible to broaden the sample to other countries or age segments. Second, we observe personality traits and employment choices contemporaneously. It may be that some traits are the result, rather than the determinant, of entrepreneurship. For example, it may be that normally-happy individuals become entrepreneurs, and that this career path makes them subsequently happy. Because we find (in an untabulated test) that the gender difference in traits is overall stronger for non-entrepreneurs, whose psyche have not been influenced by entrepreneurship, we view this "treatment" explanation as unlikely, although we cannot formally it out.[3]

Our empirical testing analysis proceeds in three steps. In the first step, we investigate how women compare to men along the the 14 personality traits (with controls for age). We find strong evidence that women, on average, have different psyche than men. Women have weaker numeracy skills and more control illusion, believe less in the fungibility of money, are less tolerant of greed and more trusting in others, have weaker internal locus of control, are less favorable towards civic engagements and less behaviorally inhibited. Interestingly, we find that women are *more* risk-avert but *less* ambiguity-avert. An ambiguity avert individual, who we identify by asking a question based on the classical Ellsberg paradox, is unwilling to make choices associated with uncertain probabilities. Ambiguity aversion is distinct from risk aversion, both conceptually (Fox and Tversky, 1995; Maccheroni, Marinacci and Rustichini, 2005) and empirically—the correlation between the two is virtually zero in our data.

In our second step, we relate the likelihood of being an entrepreneur to the 14 personality traits (with controls for gender and age). We find that, as compared with other individuals, entrepreneurs have less risk-aversion and less ambiguity-aversion. The finding pertaining risk-aversion is well-documented in prior studies, however, we are the first to use a large-scale dataset to document that entrepreneurs are also less ambiguity avert, just as Frank Knight (1921) hypothesized. We further show that entrepreneurs are more aware about the opportunity cost concept, more tolerant of greed, have stronger internal locus of control, are more favorable towards civic engagements, and are less behaviorally inhibited and happier. Differences between

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[3]As further evidence against the "treatment" explanation, Cesarini et al (2011) show that there is a strong genetic component in several of the personality traits that we study.

entrepreneurs and others regarding risk-aversion, awareness of opportunity cost, greed tolerance, behavioral inhibition and happiness do not survive controlling for twin-pair fixed effects are consistent with partly shared genetics or childhood experiences being important determinants for these traits. Our findings broadly support the popular view that entrepreneurs are outgoing people willing to cope with uncertainty.

In the third step of our analysis of gender differences in entrepreneurship, we unify the above discussed analyses. We find that, on aggregate, personality traits can explain a relatively modest fraction of the gender difference in entrepreneurship. The estimates from our probit regressions indicate between 21% and 32%.[4] Obviously, our estimates of the fraction explained by personality traits cannot be interpreted as precise figures, because they are sensitive to exactly how each trait is measured and how the statistical model is specified.

One reason why the aggregate effect of psyche is relatively modest is that is that some personality traits have gender differences but do not determine entrepreneurship, and, conversely, some traits determine entrepreneurship but have no gender difference. Another reason is that gender differences in traits do not in a clear cut way reduce women's likelikhood of being an entrepreneur. On the one hand, we find that women are less likely to be entrepreneurs because they have higher risk aversion, stronger sense of fairness, weaker internal locus of control and less favorable attitude towards civic engagements. On the other hand, we find that women are more likely to be entrepreneurs because they are less ambiguity avert and less behavioral inhibition. The existence of such opposite effects means that researchers studying only a small subset of personality traits could come to the wrong conclusion about gender differences in entrepreneurship.

A natural question to ask is what explains the gender difference in entrepreneurship that is unexplained by the 14 personality traits we study. One explanation is that there could be measurement error in the way we measure the traits (Beauchamp et at, 2011). A related explanation is that the set of personality traits we study is incomplete. One trait excluded from our analysis is over-optimism (Puri and Robinson, 2006), although we likely capture it indirectly with our happiness and locus of control traits. Another excluded trait is the willingness to compete, but it is difficult to measure this trait outside laboratory experiments (see Gneezy, Niederle and Rustichini, 2003). However, with these two exceptions, we are not aware of omitted traits which are documented by the literature to determine entrepreneurship *and* be subject to a gender

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[4]The lower figure is derived in a specification where each personality trait is captured by a dummy, and the higher figure is derived in a specification where each trait is captured by multiple dummies.

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difference.

Likely, the most important explanation is that non-psychological factors play a dominant role for the gender difference in entrepreneurship. It is beyond the scope of our paper (and the limits of our dataset) to explore the importance of such factors, but we note that previous research suggests various possibilities. One strand of the literature emphasizes gender discrimination in product and credit markets (e.g Borjas and Bronars 1989, Muravyev et al. 2009). Female business owners tend to work fewer hours, likely because of greater family responsibilities (Sanandaji and Wallen 2009). They also have less capital and are less likely to have prior experience in industry or in managerial roles compared to men (Carter et al. 1997; Boden and Nucci 2000; Fairlie and Robb 2009). Prior research also document that women are less likely to have degrees in business or technical fields, fields of study associated with entrepreneurship (Menzies et al. 2004). Another possibility is that parents make gender-based choices on how to transmit human capital to their children. Robinson (2011) shows that such transmission could be an important factor driving self-employment choices. Choice of industry also seems to be important. Du Rietz and Henrekson (2000) show that women entrepreneurs tend to be active in industries where expansion is generally more difficult, in part accounting for lower growth rate for firms headed by women. Finally, it is possible that social norms, lack of role models and cultural factors–as emphasized by the sociological and feminist literatures– may contribute to the gender difference in entrepreneurship.

In the concluding part of our empirical analysis, we compare the personality traits between self-employed non-entrepreneur and other types of non-entrepreneurs (i.e., individuals who are mployed or inactive in the labor market). Concretely, we exclude entrepreneurs from our sample, and show that only one entrepreneurial trait—lower risk aversion—is more common for self-employed non-entrepreneurs than for other non-entrepreneur individuals.[5] We also show that personality traits can explain much less of the gender gap in self-employment than the gender gap in entrepreneurship. Collectively, these findings indicate that entrepreneurship requires a special psyche, and that this psyche is different from that required for other types of self employment.

This paper contributes to the literature in psychology and, more recently, experimental economics that study gender differences in personality and psyche. Croson and Gneezy (2009) review this literature, and conclude that there are "robust [gender] differences in risk prefer-

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[5]When compare traits between entrepreneurs and self-employed non-entrepreneurs, we find that all entrepreneurial traits except one (awareness about the opportunity cost concept) remains significant in the direction we documented when comparing entrepreneurs against all other individuals.

ences, social (other-regarding) preferences, and competitive preferences". Our findings support this conclusion, showing that women differ for 11 out of the 14 personality traits that we study.

This paper also contributes to the literature that study how personality and psyche relates to entrepreneurship (see Shane, 2003, for a review). Numerous studies have linked higher tolerance for risk with a higher propensity to engage in self-employment (Kihlstrom and Laffont 1979; Rees and Shah 1986; Begley and Boyd, 1987; Stewart et al. 1999; Van and Cramer 2001, Cramer et al. 2002, Caliendo et al 2009; Roach and Sauermann, 2011), though not all studies have been conclusive, such as Cramer et al. (2002). We confirm that entrepreneurs are less risk avert, and also show that they are less ambiguity avert than other individuals. We also confirm the finding of Brockhaus (1980) and Mueller and Thomas (2001) that entrepreneurs have stronger internal locus of control. Finally, although one could argue that the personality traits we measure are not behavioral biases, our findings relate to papers linking behavioral biases to entrepreneurship (Olson, 1986; Cooper et al., 1988, Forbes, 2005; Koellinger et al., 2007; Burmeister and Schade 2007).

This paper is also related to Nicolaou et al. (2008) who, using data on British twins, find that a large fraction of the variability in the self-employment likelihood is genetic. The role of genes for self-employment strongly suggests that preferences and personality traits—in turn proven to be genetic, see for example Cesarini et al (2011)—are key determining factors of who becomes an entrepreneur.

The remainder of this paper is organized as follows. Section 2 presents evidence on the prevalence of gender differences in entrepreneurship. We introduce the sample and explain our focal variables in Section 3. Section 4 presents results on gender differences and entrepreneurship, and Section 5 presents results on entrepreneurship and self-employment. The paper ends with a brief conclusion in Section 6.

2   Evidence on the Entrepreneurship Gender Gap

Even though during the last decades the female self-employment rates have slowly climbed in the United States and most other developed countries, the gender gap in this labor market outcome remains large and ubiquitous. Table 1 illustrates this fact, by presenting self-employment statistics from United States and 33 European countries. The figures are collected from Eurostat, the U.S. Bureau of Labor Statistics, and the U.S. Census Survey of Business Owners.

Panel A reports the fraction of the working population that is self-employed. Across the

countries, the arithmetic average self-employment rate is 19% for men versus 10% for women. Hence, men are twice as likely to be self-employed than women. This pattern holds for every country that we report. Panel B reports the fraction of the working population that self-employed and employ at least one person other than the owner. Self-employed with employees is a measure likely to correspond more closely (though of course still not perfectly) with entrepreneurship. The gender gap in employer firms is even wider: across the countries, men are about three times as likely as women to be self-employed with employees.

In the United States while men are overrepresented by 70% among all self-employed, they are overrepresented by 200% among those self-employed who employ at least one external worker. In a recent Kauffman Foundation study focusing on the gender gap in U.S. entrepreneurship, Mitchell (2011) confirms that women self-employed are underrepresented as employer firms, and far less likely to have sales above one million dollar per year. Other research has shown that female-owned firms are on average smaller than male-owned ones (Coleman 2002; Robb and Wolken 2002; Fairlie and Robb 2009), and that female business owners tend to less growth oriented than their male counterparts (Orser and Hogarth-Scott 2002, Morris et al. 2006). All of this indicates that the gender gap in entrepreneurship is wider than the already large gender gap in self-employment.

3 Data

3.1 Sample

We obtain our data from The Swedish Twin Registry, which is the largest twin registry in the world. Beginning in early 2009, the registry sent out a detailed survey—Screening Across the Life-span Twin (SALTY)—to 24,914 Swedish twins born between 1943 and 1958. A total of 11,743 individuals answered the survey, reflecting a response rate of 47%. Each respondent answered a battery of detailed questions on his or her economic preferences, risk and ambiguity attitudes, and behavior. The questions were designed by a team of researchers based on existing theoretical and empirical work in economics, psychology, and behavioral science. To construct our final sample, we exclude 4,403 individuals who did not answer all the survey questions that we use to create the 14 personality traits we study. Panel A of Table 2 summarizes our sample. We study 7,331 individuals, of whom 49% are women and 51% men.

Cesarini et al. (2011) merge the SALTY survey data with information from Swedish administrative records, and make an in-depth investigation of the population representativeness

of this sample using that data. Comparing income, education and other similar variables with the Swedish average, they find that the twin sample is observationally representative of the Swedish population as a whole.[6] This evidence corroborates previous research, which shows that twins are similar to the full population in most important dimensions, including personality and psyche (Kendler et al 1995, Johnson et al 2002). This fact enables population validity of our findings, a key assumption of the growing economic literature that uses twins (surveyed in Cesarini et al 2009) to study economic behavior.

3.2 Self-Employment and Entrepreneurship

Each respondent was asked a series of questions about self-employment and business ownership. The fraction of the sample who was self-employed, including both entrepreneurs and other types of self-employed individuals, is 16%. The figure is twice as high for men (22%) as for women (11%), confirming a gender gap in self-employment.

While self-employment is an interesting phenomenon in and out of itself, the attention afforded to it by researchers and policy makers largely reflects the belief that it is a proxy for innovative entrepreneurship. When academics and business leaders were asked to define entrepreneurship, the most common choices were the creation and development of new ventures followed by innovation. In contrast "the creation of a mom-and-pop business" was not viewed as entrepreneurship (Gartner 1990). As an empirical matter, the overwhelming majority of self-employed individuals are not entrepreneurs in the Schumpeterian sense, as they do not bring a new innovation to the market or plan to grow their business. Rather, many of them are construction workers, shop owners, taxi and truck drivers, gardeners, plumbers, fast food vendors, hair-dressers, and on the more high skilled end lawyers, physicians, consultants and accountants who have chosen a particular legal employment form in which to perform their work.[7]

The Census Bureau's Survey of Business Owners provides several pieces of evidence that self-employment is not equal to entrepreneurship: Firstly, the median business owner who works full time has zero employees. Secondly, of small firms started in 2002, later 90% were four years later either out of business or had fewer than five employees. Hurst and Pugley (2010) provide

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[6]The twins have marginally higher average income and marriage rates, slightly lower birth weight, but no differences in educational attainment.

[7]In the U.S., the industries with the largest concentrations of self-employed men are construction, landscaping services, auto repair, restaurants, truck transportation, and crop production (farmers). For women, the industries are private households (cooks, maids, caretakers), child day care services, services to buildings (janitors and cleaners), restaurants and beauty salons.

a wide range of survey evidence suggesting that the vast majority of American self-employed neither innovate nor intend to innovate, nor grow or intend to grow. Though some small-scale ventures are indeed nascent entrepreneur who had not yet had time to grow, this tiny segment is in practice dominated in the data by the large numbers of non-entrepreneurial self-employed.

The distinction between entrepreneurship and other types of self-employment has implications for the psychological literature on entrepreneurship. Theories are designed for the psychology of Schumpeterian entrepreneurs, but commonly tested using self-employment as a proxy for entrepreneurship. The traits required to be an entrepreneurs may be different than the traits required to be a self-employed plumber or dentist. For instance, as Knight (1921) argued innovative businesses need to deal with uncertainty associated with bringing truly novel products and technologies to the market. However, a self-employed plumber or dentist who sells a familiar product does not typically need to wrestle with uncertainty about the distribution of outcomes, for example regarding consumer demand or the technological feasibility of some projects. Using the self-employed to test Knights theory about entrepreneurs might lead to misleading results. Our evidence in Section V is consistent with this expectation.

Though we cannot hope to perfectly separate the self-employed from entrepreneurs, we make an attempt to remove at least those who are obviously not entrepreneurs. For this purpose, we included in the SALTY survey a question that explicitly distinguishes entrepreneurship from other types of self-employment:

"Sometimes it is desirable to differentiate between being an entrepreneur and being self-employed. An entrepreneur commercializes a new innovation or idea. An entrepreneur has, or plans to have, a number of employees and strives to expand the business. A self-employed person owns and runs his/her own company, for instance a restaurant or a law firm, where he/she works. A self-employed person normally does not strive to expand over a certain limit and has 0 or a few employees. Would you say that you are primarily an entrepreneur or a self-employed person?"

Using this question to identify entrepreneurs, we find that the gender difference for entrepreneurship is much stronger than for self-employment. As reported in Panel A of Table 2, there are close to five times as many male entrepreneurs (9%) than female ones (2%), which means that 40% of self-employed males self-identify as entrepreneurs compared to only 18% of self-employed women.

One objection to our measure of entrepreneurship is that it is self-reported. It may be that

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some individuals state in the survey that they want to expand their company, not because they are true entrepreneurs but rather because they are over-optimistic or like to boast. If men were more prone than women to such misreporting, then this could be one explanation to the observed gender difference in entrepreneur. In an unreported test, we find evidence that contradicts this explanation: the compensation premium to entrepreneurship (which is positive), is significantly higher for men than for women.[8] If men were more biased towards over-claiming an entrepreneurial status, one would expect them to have a lower compensation premium than women.

3.3   Personality Traits

We now describe how we measure the 14 personality traits that are the focal variables of our empirical analysis. Appendix A lists the survey questions used to measure each trait. For each trait, we code the relevant survey questions based on the individual's responses, and add up codings for the trait. We then create a dummy variable that is 1 if the coding shows that the individual is above the sample median for the particular trait, and is 0 otherwise. Several traits, for example *ILLUSION-OF-CONTROL* and *AMBIGUITY-AVERSION*, are identified with only one survey question each—in such cases, we create a dummy variable that is 1 if the question shows that the individual has the trait, and is 0 otherwise. The aggregation of survey responses into dummy variables has the advantage of making it easier to interpret estimated coefficients. One disadvantage, however, is that the aggregation may remove relevant information from the data. This could amplify the measurement error when we study the importance of personality traits for explaining the gender differences in entrepreneurship. To mitigate this error, we also do a test using the disaggregate measure of each trait.

Panel B of Table 2 reports the mean of each trait and its cross-correlation with all other traits. We note that the cross-correlations are overall relatively small: only 8 out of 91 correlations are above an absolute value of 0.1. This indicates that the traits capture unique dimensions of the individual's psyche. The low cross-correlations also mean that we can include all of them as independent variables without running into multi-collinearity problems.

We capture four traits that measure the individual's attitude towards various types of risk and the timing of payoffs, respectively. We infer the trait *RISK-AVERSION* from hypotheti-

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[8]Compensation data come from Swedish administrative records from 1996-2000 (i.e., a decade before the survey date), and includes wage labor, income from own business, pension income and unemployment compensation The compensation premium to entrepreneurship - measured using twin-fixed effects - is SEK 54K for men and SEK 20K for women. The average earning in our sample is SEK 290K.

cal choice questions about the individual's willingness to substitute safer future income against riskier, higher future income. A conceptually related trait is *LOSS-AVERSION*, which we also infer from hypothetical choice questions about the individual's willingness to substitute a safer lottery prize against a risker, more valuable lottery prize. The difference between *RISK-AVERSION* and *LOSS-AVERSION* is that the latter involves much smaller amounts than the former (see Kahneman and Tversky, 1992, for more detail on the importance of this difference). We also infer *AMBIGUITY-AVERSION* from a hypothetical choice question that builds on the classic Ellsberg (1961) paradox. Whereas *RISK-AVERSION* and *LOSS-AVERSION* measure the individual's appetite for uncertainty pertaining to final outcomes, *AMBIGUITY-AVERSION* is different because it measures the individual's appetite for uncertainty for the process. Studying the cross-correlation matrix, we find that *RISK-AVERSION* and *LOSS-AVERSION* have a positive correlation of 0.14, but *AMBIGUITY-AVERSION* is uncorrelated with these traits. Finally, we use another set of hypothetical choice questions to infer *LONG-TERM-TIME-PREFERENCE*, a trait capturing how strong the individual's preference is for receiving payoffs later versus earlier.

We identify five traits that capture, each in its own unique way, how much the individual resembles the profit-making decision-maker envisioned by economics. We measure the individual's cognitive ability with respect to numerical calculations, which we label *NUMERACY*.[9] [10] We also capture whether the individual suffers from *ILLUSION-OF-CONTROL*, i.e. have the irrational belief that he/she can influence a lottery outcome that—by design—is outside his/her control. We measure *FUNGIBILITY-OF-MONEY* by hypothetical choice questions based on Tversky and Kahneman (1981). The basic idea of these questions is to identify individuals who view money as having intrinsic value beyond their actual consumption value. As a related trait, we measure whether the individual values a thing based on its purchase price or on its current market value. We call this trait *OPPORTUNITY-COST-AWARENESS*. Finally, we measure to what extent the individual is willing to accept outcomes that follow from market economic forces, but may be viewed as socially unjust. We call this trait *GREED-TOLERANCE*. [11]

We identify three traits that, in a broad sense, capture the individual's view of himself and others. We ask the individual if he/she feels that one could trust others, a trait we label

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[9]In an unreported analysis, we find that for men, this trait has a significantly positive correlation with the score on the Swedish Military's standardized intelligence test.

[10]Cesarini et al, 2011, denotes this trait "the representativeness heuristic".

[11]The questions measuring this trait are based on Kahneman et al (1986).

TRUST-IN-OTHERS. The trait *LOCUS-OF-CONTROL* measures to how strongly the individual believes that that one's own efforts matter for life outcomes rather than fate and luck. With the exception of risk preferences, *LOCUS-OF-CONTROL* is the personality trait that has most strongly been linked with entrepreneurship in the literature. We also identify the individual's attitude towards civic engagements, and label this trait *CIVIC-MINDEDNESS*. A high *CIVIC-MINDEDNESS* means that the individual is willing to donate blood, organs (in the case of death), and contribute with time and money to non-profit civic activities. It is important to note that *CIVIC-MINDEDNESS* is measured based on the individual's actual actions, rather than his/her beliefs or stated preferences. For this reason, this trait may be more influenced by a treatment effect from being an entrepreneur.

Finally, we identify two traits that capture the individual's behavioral inhibition and happiness, respectively. We measure *NON-BEHAVIORAL-INHIBITION*, which shares some similarity with extroversion, through a series of question about how actively the individual interacts with other people. We measure *HAPPINESS* by a straightforward question about how happy the individual would describe him/herself to be. As expected *NON-BEHAVIORAL-INHIBITION* and *HAPPINESS* are positively correlated (0.13), and they are both positively correlated *TRUST-IN-OTHERS* (0.15 and 0.14, respectively).

4 Results on Gender, Entrepreneurship and Psyche

We next study to whether and how gender differences in psyche explain gender differences in entrepreneurship. We conduct this investigation in three steps. First, we analyze which personality traits differ between women and men. Second, we analyze which traits differ between entrepreneurs and other individuals. Third, we combine these two analyses, and make inferences about (i) what is the aggregate effect of all traits on the gender difference in entrepreneurship, and (ii) which traits contribute to this effect.

4.1 Gender and Psyche

To relate personality traits to gender, we run a probit regression where the dependent variable is *FEMALE-GENDER*, i.e. is 1 if the individual is a woman, and is 0 if the individual is a man. We include fixed effects for the individual's age, and cluster residuals by twin pair (regressions without such clustering yield qualitatively similar results). We also include the 14 personality traits. Table 3 presents the results. A positive (negative) coefficient means that an entrepreneur

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is more (less) likely to possess a certain trait.

Consistent with the prior literature, we document that women are less risk avert and loss avert. However, we also find that the opposite is true for ambiguity aversion: *women are less ambiguity avert.* Even though all our aversion traits stem from the individual's attitude towards uncertainty, ambiguity aversion is conceptually and empirically distinct from risk aversion and loss aversion (with close to zero cross-correlation correlations). One interpretation of our findings is that women are worse at handling uncertainty related to work outcomes, but better at handling uncertainty related to the work processes.

We also show that women are worse at numeracy, have more control illusion, but believe more in the fungibility of money. They also have less tolerance for greed, more trust others, have weaker internal locus of control and a less favorable attitude towards civic engagements. Finally, women are more behaviorally inhibited than men. Overall, we find statistically significant differences for 11 of the 14 personality traits we study. Hence, there are extensive gender differences in psyche.

We confirm this conclusion in a series of robustness tests. In a first set of tests, which are unreported, we run separate regressions for each personality trait. We find that all traits, except behavioral inhibition, that are significant in Specification 1 of Table 3 remain significant. In a second set of tests, presented in Robustness Table 1, we replicate in Specification 1 of model 3 but additional control variables. The control variables are *YEARS-EDUCATION* (Specification 1), *ANNUAL INCOME* (Specification 2), *MARRIED-DUMMY* (Specification 3), and *NUMBER-OF-CHILDREN* (Specification 4).[12] We find that the inclusion of either control variable does not alter the coefficients on the personality traits.

One limitation of our tests is that they do not identify whether the gender difference in psyche is due to the individuals' genetics and pre-employment experiences, or the result of treatment effects from the individual's employment choice. One possibility is that women differ along the personality traits we study, simply because there are fewer female entrepreneurs. In an untabulated test, we find evidence contradicting this explanation. Concretely, we show that the gender differences in traits remains qualitatively similar even if we exclude either entrepreneurs or all self-employed individuals from the sample.

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[12]Income data are collected from 1996-2000, i.e. a decade before our survey date. The coefficient on this control must therefore be interpreted with some caution.

4.2 Entrepreneurship and Psyche

We next relate personality traits to the likelihood of being an entrepreneur. We run probit regressions where the dependent variable is 1 if the individual is an entrepreneur, and is 0 otherwise. We include fixed effects for the individual's age, and cluster residuals by twin pair (regressions without such clustering yield qualitatively similar results).

Results are presented in Table 4. Specification 1 includes as independent variable only the *FEMALE-GENDER* dummy, and Specifications 2-3 add the 14 personality traits. We first turn our attention to the coefficients on the traits reported in Specification 2. A positive (negative) coefficient means that an entrepreneur is more (less) likely to possess a certain trait. We find that entrepreneurs are less risk avert and less ambiguity avert. These traits are both related to uncertainty, however, ambiguity aversion is conceptually and empirically distinct from risk aversion. Our finding that these traits are different for entrepreneurs is consistent with entrepreneurial work tasks being uncertain in both their execution and outcome. Although the linkage between entrepreneurship and risk aversion is well-documented (Kihlstrom and Laffont 1979; Rees and Shah 1986; Stewart et al. 1999; Van Praag and Cramer 2001, Caliendo et al 2009), we are the first to use a large-scale dataset to show the linkage between entrepreneurship and ambiguity aversion.

We further show that entrepreneurs are more aware about opportunity cost and more tolerant of greed. These are intuitive results, because a person launching an innovative firm requires the ability to make cogent business decisions. Finally, we show that entrepreneurs have stronger internal locus of control and a more favorable attitude toward civic engagements, are less behaviorally inhibited and happier. Our results on locus of control corroborate the findings of existing studies (Brockhaus, 1980; Mueller and Thomas, 2001). Overall, these traits are consistent with the view that entrepreneurship requires an outgoing, "salesman" personality type.

We conduct a series of robustness tests to validate our results. In a first set of tests, which are unreported, we run separate regressions for each personality trait. We find that all coefficients that are significant in Specification 2 of Table 4 remain significant. In a second set of robustness tests, presented in Robustness Table 2, we replicate Specification 2 of Table 4 but also include an additional control variable. The control variables are *YEARS-EDUCATION* (Specification 1), *ANNUAL INCOME* (Specification 2), *MARRIED-DUMMY* (Specification 3), and *NUMBER-OF-CHILDREN* (Specification 4). These controls are informative because they capture other important inter-personal differences, however, their endogenous nature make their coefficients difficult to interpret. Importantly, for our purposes, we find that neither control has any sub-

stantive effect on the magnitude of *FEMALE-DUMMY*, or on the personality trait variables. From this we infer that the above discussed results are robust in the sense that they are not explained by differences in education, income, or family. Specification 5 of Robustness Table 2 includes 5,788 twin-pair fixed effects. We find that some entrepreneurial traits remain significant, whereas others become insignificant. We infer that genetics and childhood experiences that twins share can partially explain why entrepreneurs have different psyche than other individuals.

4.3 The Effect of Gender Differences in Psyche on Entrepreneurship

We next compute the aggregate effect of the gender differences in personality traits on the likelihood of being an entrepreneur. We compare the coefficient on the *FEMALE-GENDER* dummy in Specification 1, which excludes all traits, to the same coefficient in Specification 2 of Table 4, which includes all traits. We find that the inclusion of traits reduces the coefficient estimate from 6.9 percentage points to 5.5 percentage points, which reflects a 21% decline. To investigate how this result is affected by our aggregation of the personality traits, we re-run Specification 2 but replace the trait dummies with fixed effects capturing each unique coding based on the survey questions. For example, we include 4 dummies for the *HAPPINESS* trait, because the survey question had four possible answers, ranging from least to most happy). Similarly, we include 20 dummies for the *TRUST-IN-OTHERS* trait, because there were two trust-related questions, and each had a possible answer from 1 (least trusting) to 10 (most trusting). Some traits, for example *AMBIGUITY-AVERSION*, are measured only with one question and two possible answers. In such cases the fixed effect for traits is the same as the dummy used in our other Specifications. Specification 3 shows result with only the coefficient on *FEMALE-GENDER* reported for brevity. We find that the coefficent on *FEMALE-GENDER* is 4.7 percentage points, which reflects a 32% decline from Specification 1 without any personality trait variables.[13] We conclude from all these tests that gender differences in psyche can explain a relatively modest fraction of the gender differences in entrepreneurship.

We next analyze which particular traits contribute to this effect of gender differences in psyche on entrepreneurship. We compare Specification 1 of Table 3 with Specification 2 of Table 4. We find that six personality traits—risk aversion, ambiguity aversion, greed tolerance, locus of control, civic mindedness, and behavioral inhibition—are significantly different for both women

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[13]In an untabulated set of tests, we redo the above specifications but use OLS as the estimation technique instead of probit. We find qualitatively similar coefficients on the personality traits, and that the gender difference in traits explains between 16%-22% of the gender gap in entrepreneurship.

and for entrepreneurs. Hence, there are five gender differences in psyche that do not have any significant effect on gender differences in entrepreneurship, because these traits are not more (or less) prevalent for entrepreneurs. Also, there are two gender differences for entrepreneurs that do not have any significant effect on gender differences in entrepreneurship, because these traits are not more (or less) prevalent for women. This finding is one reason why we find a relatively modest aggregate effect of the gender differences in psyche on the likelihood of being an entrepreneur.

Another reason is that there are opposite effects for the personality traits that are significantly different for both women and entrepreneurs. On the one hand, women are less likely to be entrepreneurs because they are more risk avert, have weaker internal locus of control, have stronger sense of fairness, and are less positive towards civic engagements. On the other hand, women are more likely to be an entrepreneur because they are less ambiguity avert and less behaviorally inhibited.

The final reason is that each trait has a small marginal effect. Multiplying the coefficients in Specification 1 of Table 3 with those in Specification 2 of Table 4, we find that the traits with the largest marginal effect—risk aversion, greed tolerance and civic mindedness—each contribute to less than 0.25 percentage points of the gender difference in entrepreneurship, which is small compared with the 6.9 percentage point gender difference found without controlling for personality traits. Importantly, the effect of entrepreneurial traits more common for women (i.e., ambiguity aversion and low behavioral inhibition) are much smaller than that effects of entrepreneurial traits more common for men.

4.4   Gender Differences in Importance of Psyche for Entrepreneurship

One possibility is that part of the gender gap in entrepreneurship could be due to gender differences in how much different traits matter for the likelihood of being an entrepreneur. For example, it may be that women are not only generally less risk avert than their male counterparts (as our findings show), but this difference could be particularly large for those who women are entrepreneurs. To test this possibility, we create 14 new variables that interact *FEMALE-GENDER* with each personality trait. We then replicate Specification 2 of Table 4 but also include these interactions as independent variables. If the hurdle was different for women, we would expect to find several significant coefficients on the interaction variables.

Table 5 present results on the interaction variables, with other independent variables unreported for brevity. We find a a weakly-significant negative coefficient on the interaction with

FUNGIBILITY-OF-MONEY. Combined with our finding in Table 3 that women believe in general more in the fungibility of money, this interaction result suggests that female entrepreneurs are less different than male entrepreneurs along this personality trait. We find a significantly positive coefficient on *OPPORTUNITY-COST-AWARENESS*. Combined with our finding in Table 4 that entrepreneurs are more aware about the opportunity cost concept, this interaction result suggests that this difference in psyche applies less to women than to men. Aside from these two results, we infer that the impact of a trait on entrepreneurship is about the same for men and women.

5 Results on Self-Employment and Psyche

5.1 Non-Entrepreneurial Self-Employment and Psyche

We conclude our empirical analysis by investigating whether self-employed non-entrepreneurs differ from other individuals in the same way entrepreneurs do. We replicate the analyses of Table 4, but exclude entrepreneurs from the sample and use a dependent variable that is 1 if the individual is a self-employed non-entrepreneur, and is 0 otherwise. Results are presented in Table 6. In Specification 2, which includes the personality traits, we find that with one exception—risk aversion—the traits common among entrepreneurs are *not* common for self-employed non-entrepreneurs.

Moreover, we find that self-employed non-entrepreneurs differ from others along several traits for which there is no difference between entrepreneurs and others. Concretely, self-employed non-entrepreneurs have lower time discount rate, lower control illusion, higher fungibility of money, and less trust in others. These patterns suggest that the psychological determinants of entrepreneurship and other types of self-employment are markedly different from each other. In an untabulated test, we compare the personality traits between entrepreneurs and self-employed non-entrepreneurs, and show that 6 traits are qualitatively the same (and statistically significant) as in Specification of Table 4. These findings highlight that researchers who want to study entrepreneurship must distinguish this phenomenon from other types of self-employment. This separation is very important in practice, because a sample of self-employed individuals typically include more non-entrepreneurs than entrepreneurs (there are twice as many in our dataset). Unfortunately, most established datasets do not separately identify entrepreneurs, making it difficult to draw reliable conclusions on entrepreneurship.

5.2 The Effects of Gender Differences in Psyche on Non-Entrepreneurial Self-Employment

Table 6 also provide evidence on the extent by which personality traits can explain gender differences in non-entrepreneurial self-employment. Comparing the coefficient on the *FEMALE-GENDER* dummy across Specifications 1-3, we find that the inclusion of the 14 personality traits make the gender difference decline from 5.5 percentage points to 5.0 percentage points. Interestingly, this decline of about 9% is considerably lower than the corresponding 32% decline we found for entrepreneurs. This difference suggests that gender difference in psyche are a much more important factor for entrepreneurship than for other types of self-employment, another manifestation that the two phenomena are distinct.

6 Conclusion

We study whether and how the gender difference in entrepreneurship can be explained by gender differences in psyche. The scale and scope of our survey dataset, which includes Swedish middle-aged twins, information about 14 distinct personality traits. Some of these traits have been studied previously in the entrepreneurship literature, but we include several new ones (e.g., ambiguity aversion), and measure others (such as risk) directly using experimentally validated questions.

In our empirical testing, we show that women have markedly different psyche than men (11 out of 14 traits are significant). Moreover, we show that entrepreneurs have different psyche than non-entrepreneurs (8 out of 14 traits are significant). Entrepreneurs are less risk avert, less ambiguity avert, more aware about the opportunity cost concept, more tolerant of greed, have stronger internal locus of control, and are more favorable towards civic engagements, and are less behaviorally inhibited and happier. We find that gender differences in psyche can, in aggregate, explain a relatively modest fraction, about 21%-32%, of the gender gap in entrepreneurship. The effect is relatively modest because (i) some personality traits with gender differences do not determine entrepreneurship, (ii) some traits that determine entrepreneurship have no gender difference, and (iii) for the traits that determine entrepreneuership and have gender difference, there are opposite effects. We also show that personality traits can explain a much less of the gender difference in non-entrepreneurial self-employment than it can for the gender difference in entrepreneurship.

Our conclusion is that while personality traits are highly correlated with entrepreneuership, gender differences along these cannot fully explain why there is a large gender gap in

entrepreneurship. External factors, be it the education system, the labor market, traditional household division of labor, the role of the public sector, discrimination or social norms must be taken into account to explain why women are underrepresented as entrepreneurs.

Although our main aim is to shed new light on the gender differences in entrepreneurship, we also make contribution to the literature by documenting which personality traits are more prevalent for entrepreneurs, and by showing that most of these entrepreneurial traits are not more common for non-entrepreneurial self-employed.

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8 Appendix A: Survey Questions For Each Psychological Trait

We below list the questions used to measure each psychological trait. These questions have been translated from Swedish. 1 SEK is approximately 1/7 USD (September 2011). Please note that the order of questions appear below does not always correspond to the order of these questions were asked in the SALTY survey.

8.1 RISK-AVERSION

1. Imagine the following hypothetical situation. You are the sole provider of your household and you have the choice between two equally good jobs: Job A will with certainty give you SEK 25,000 per month after taxes for the rest of your life. Job B will give you a 50-50 chance of SEK 50,000 per month after taxes for the rest of your life, and a 50-50 chance of SEK 20,000 per month after taxes for the rest of your life. Which job do you choose?

- Job A

- Job B

2. Imagine the following hypothetical situation. You are the sole provider of your household and you have the choice between two equally good jobs: Job A will with certainty give you SEK 25,000 per month after taxes for the rest of your life. Job B will give you a 50-50 chance of SEK 50,000 per month after taxes for the rest of your life, and a 50-50 chance of SEK 22,000 per month after taxes for the rest of your life. Which job do you choose?

- Job A

- Job B

3. Imagine the following hypothetical situation. You are the sole provider of your household and you have the choice between two equally good jobs: Job A will with certainty give you SEK 25,000 per month after taxes for the rest of your life. Job B will give you a 50-50 chance of SEK 50,000 per month after taxes for the rest of your life, and a 50-50 chance of SEK 17,000 per month after taxes for the rest of your life. Which job do you choose?

- Job A

- Job B

8.2 LOSS-AVERSION

1. Imagine that yould participate in a lottery where you can toss a coin to determine if you will win SEK 2000 (heads in the toin toss) or lose SEK 1000 (tails in the coin toss). Would you choose to participate in the lottery?

- Yes

- No

2. Imagine that you could participate in a lottery where you can toss a coin to determine if you will win SEK 1500 (heads in the coin toss) or lose SEK 1000 (tails in the coin toss). Would you choose to participate in the lottery?

- Yes

- No

3. Imagine that yould participate in a lottery where you can toss a coin to determine if you will win SEK 2500 (heads in the coin toss) or lose SEK 1000 (tails in the coin toss). Would you choose to participate in the lottery?

- Yes

- No

8.3 AMBIGUITY-AVERSION

1. Imagine that there is an urn with 30 red balls and 60 other balls which are either black or yellow. The number of balls of each color is determined in advance, but you do not know the exact number of balls that are black or yellow, just that the total number is 60. The balls are well mixed so that every ball has the same chance of being drawn. Imagine that you could draw one ball from this urn and that you can choose between three different lotteries. Which lottery would you choose?

- Lottery A: You receive SEK 900 if a red ball is drawn

- Lottery B: You receive SEK 1000 if a black ball is drawn

- Lottery C: You receive SEK 1000 if a yellow ball is drawn

8.4 LONG-TERM-TIME-PREFERENCE

1. Imagine that you can choose between receiving a sum of money today, or to wait and receive a larger sum in one week. Which would you choose?

- SEK 5000 today
- SEK 6000 in a week

2. Imagine that you can choose between receiving a sum of money today, or to wait and receive a larger sum in one week. Which would you choose?

- SEK 5000 today
- SEK 7000 in a week

3. Imagine that you can choose between receiving a sum of money today, or to wait and receive a larger sum in one week. Which would you choose?

- SEK 5000 today
- SEK 5500 in a week

8.5 NUMERACY

1. Linda is 31 years old, single, outspoken and very talented. She has a university degree in philosophy. As a student she was very involved in discrimination and social justice issues. She also participated in several anti nuclear demonstrations. Which of the following alternatives is the most likely?

- A: Linda works in a bank
- B: Linda works in a bank and is active in the feminist movement
- Alternative A
- Alternative B

2. Kalle is attractive, athletic, drives a Mercedes and has a very attractive girlfriend. Which of the following alternatives is the most likely?

- A: Kalle is a professional tennisplayer
- B: Kalle works as a nurse

- Alternative A

- Alternative B

3. There are two hospitals in a city. In the big hospital, 45 children are born every day, and in the small hospital 15 children are born every day. On average 50

- The big hospital

- The small hospital

4. Imagine that you toss a coin 8 times. Which of the following two outcomes is the most likely?

- A: Head, Head, Tail, Head, Tail, Tail, Head, Head

- B: Tail, Head, Tail, Head, Tail, Head, Tail, Head

- Alternative A

- Alternative B

- Both are equally likely

8.6 ILLUSION-OF-CONTROL

1. Imagine that you could participate in one of the two lotteries below, where the chance of winning is the same.

- Lottery 1: You are allocated a lottery ticket and every one in a thousand of the participants will win SEK 10000

- Lottery 2: You can pick a lottery ticket yourself and every one in a thousand of the participants will win SEK 9000

Which of these two lotteries would you choose?

- Lottery 1

- Lottery 2

8.7 FUNGIBILITY-OF-MONEY

1. Imagine that you have decided to watch a play that costs SEK 100. When you enter the theatre to buy the ticket you discover that you have lost a SEK 100 bill. Will you still pay SEK 100 to watch the play?

- Yes

- No

2. Now imagine that you have decided to watch a play and that you have already bought a ticket for SEK 100. When you enter the theatre you discover that you have lost the ticket. It is impossible to get a refund for the lost ticket. Would you buy a new ticket for SEK 100?

- Yes

- No

8.8   OPPORTUNITY-COST-AWARENESS

1. Imagine that you a year ago bought a box of rare wine for the price of SEK 250 per bottle. At the latest auction in Stockholm this same wine was sold for SEK 750 per bottle. Which of the following alternatives is the best description of your cost of drinking a bottle of the wine?

- SEK 0

- SEK 250

- SEK 250 + interest

- SEK 750

8.9   GREED-TOLERANCE

1. A hardware store has been selling snow shovels for SEK 150. The morning after a large snowstorm the store raises the price to SEK 200. How fair do you think that is?

- Completely fair

- Acceptable

- Unfair

- Very unfair

2. A company is making a small profit. However, due to a recession the unemployment is high and it is easy to hire people. The company therefore decides to decrease wages and salaries by 10

- Completely fair

- Acceptable

- Unfair

- Very unfair

3. A small factory is making kitchen tables. Because of changes in the price of materials, the cost of making each table has decreased by SEK 200. But the factory does not lower its price for the tables. How fair do you think that is?

- Completely fair

- Acceptable

- Unfair

- Very unfair

8.10 TRUST-IN-OTHERS

1. Generally speaking, would you say that most people can be trusted or that you need to be very careful in dealing with people? Please tick on the scale below, where the value 0 means "need to be very careful" and the value 10 means "most people can be trusted".

- Need to be very careful (0)— Most people can be trusted (10)

2. Do you think that most people would try to take advantage of you if given the opportunity, or do you think that most people would treat you correctly. Please tick on the scale below, where the value 0 means "would take advantage of me" and the value 10 means "would treat me correctly".

- Would take advantage of me (0)—Would treat me correctly(10)

8.11 LOCUS-OF-CONTROL

Choose the most appropriate between the following paired sentences:

1.

- Difficulties in life depend partly on bad luck.

- Difficulties in life depend on mistakes that people make.

2.

- An important reason why there are wars is that people are not sufficiently interested in politics.

- Wars will always exist regardless of people's efforts to prevent them.

3.

- In the lon-run, people get the respect they deserve.
- Unfortunately, a person may not realize his/her value regardless of how hard he/she tries.

4.

- The idea that teachers may be unfair to students is absurd.
- Most students do not realize the extent by which their grades are affected by luck

5.

- Without luck, one cannot become an effective leader.
- Capable people who fail at becoming leaders have not exploited the possbilities given to them.

6.

- Regardless how hard someone tries, there are always some people who dislike you.
- People who are not liked do not understand how to interact with others.

7.

- Destiny determines what happens in life.
- Trusting destiny has never worked as well for me as making decisions based on a plan of action.

8.

- To succeed is a function of hard work, and has little or nothing to do with luck.
- To get a good job, one needs to be at the right place at the right time.

9.

- The average citizen can affect how the government makes decisions..
- The world is ruled by a few powerful people, about which the ordinary person cannot do anything.

10.

- When I make plans, I am almost certain that I can fulfill them.

- It is not wize to plan far in advance because many things are heavily influenced by luck.

11.

- In my case, getting what I want has nothing to do with luck.

- Often, one could make a decision simply based on a coin flip.

12.

- What happens to me is my responsibility.

- Sometimes I feel that I am not in sufficient control over my life's direction.

8.12 CIVIC-MINDEDNESS

1. Are you a registered blood donor?

- Yes

- No

 2. Are you registered as an organ donor?

- Yes

- No

3. How much money do you give to charity?

- SEK 0 per year

- Less than SEK 100 per year

- SEK 100-500 per year

- SEK 500-1000 per year

- SEK 1000-3000 per year

- SEK 3000-5000 per year

- More than SEK 5000 per year

4. How much time do you devote to unpaid voluntary work?

- 0 hours per week

- Less than 1 hour per week

- 1-2 hours per week

- 2-5 hours per week

- 5-10 hours per week

- More than 10 hours per week

8.13 NON-BEHAVIORAL-INHIBITION

Each below question has the answer alternatives

- Yes

- No

1. Do you tend to become vigilant and wary of your surroundings?

2. Do you feel awkward when you are approached by someone new?

3. Do you tend to become quiet?

4. Do you tend to approach people whom you don"U2122t know and talk to them?

5. Do you tend to spend time observing strangers from a distance first, before being able to mix in?

6. Do you tend to be chatty in conversation when you are speaking to someone new?

7. Are you likely to spend most of your time next to a person whom you know well?

8. Do you tend to feel physically anxious (e.g. racing pulse, sweaty, butterflies)?

9. Do you tend to introduce yourself to new people?

10. Do you tend to keep a fair distance away from strangers?

11. Do you tend to withdraw and retreat from those around you?

Generally, not just in new or unfamiliar situations:

12. Do you prefer your own company over the company of others?

13. Do you usually enjoy going to social events with large crowds of people?

14. Would you tend to choose solitary leisure activities over spending time with close friends?

15. Do you prefer to be surrounded by lively activity rather than a quiet gathering?

8.14   HAPPINESS

Would you, in general, describe yourself as:

- Very happy

- Rather happy

- Not very happy

- Not at all happy

Table 1: Statistics on Self-Employment Rate In United States and European Countries

This table lists the fraction of employed individuals who are self-employed. Panel A includes all self-employed individuals, and Panel B includes only self-employed individuals who employ others (i.e., a better definition of entrepreneur). Men/Women is the ratio of the fraction of self-employed men over the fraction of self-employed women. The figures for the Switzerland and the United States refers to 2009. European data comes from own calculations based on the Eurostat database, including those above the age of 15 who are employed. Since Eurostat does not include data for the United States, we rely on the Bureau of Labor Statistics for a measure of American self-employment (Hipple 2010). The Bureau of Labor Statistics record if the firm employs others than the owner for the two thirds of American self-employed who are unincorporated, but not for incorporated firms. We therefore estimate the employer share of this group using data from the Census Survey of Business Owners from 2007.

	Panel A: Self-Employed			
	All	Women	Men	Men/Women
Austria	11.6%	8.9%	14.0%	1.6
Belgium	13.4%	9.0%	17.0%	1.9
Bulgaria	11.7%	8.9%	14.3%	1.6
Croatia	19.8%	17.2%	22.1%	1.3
Cyprus	16.7%	10.2%	22.2%	2.2
Czech Republic	17.1%	11.1%	21.6%	1.9
Denmark	8.5%	4.8%	11.9%	2.5
Estonia	8.0%	5.1%	11.2%	2.2
Finland	12.8%	8.5%	16.9%	2.0
France	10.9%	6.7%	14.7%	2.2
Germany	11.0%	7.5%	14.0%	1.9
Greece	30.3%	22.1%	35.8%	1.6
Hungary	11.9%	8.4%	15.0%	1.8
Iceland	12.5%	8.3%	16.3%	2.0
Ireland	16.4%	6.9%	24.6%	3.6
Italy	23.6%	16.2%	28.6%	1.8
Latvia	10.1%	8.0%	12.3%	1.5
Lithuania	9.3%	7.2%	11.5%	1.6
Luxembourg	7.7%	6.1%	9.0%	1.5
Macedonia	18.5%	8.4%	24.8%	3.0
Malta	14.2%	6.1%	18.4%	3.0
Netherlands	14.4%	10.4%	17.8%	1.7
Norway	7.5%	4.1%	10.5%	2.5
Poland	18.9%	14.4%	22.7%	1.6
Portugal	21.8%	18.9%	24.3%	1.3
Romania	21.7%	13.6%	28.1%	2.1
Slovakia	15.8%	9.2%	21.2%	2.3
Slovenia	12.4%	7.8%	16.2%	2.1
Spain	16.0%	11.4%	19.6%	1.7
Sweden	**10.7%**	**6.2%**	**14.7%**	**2.4**
Switzerland	13.1%	10.2%	15.5%	1.5
Turkey	25.5%	14.1%	30.0%	2.1
United Kingdom	13.7%	8.7%	18.0%	2.1
United States	10.9%	7.9%	13.7%	1.7
AVERAGE	14.7%	9.8%	18.5%	2.0

Table 1 continued

	Panel B: Self-Employed with Employees			
	All	Women	Men	Men/Women
Austria	4.8%	2.7%	6.6%	2.5
Belgium	4.5%	2.4%	6.2%	2.6
Bulgaria	3.8%	2.4%	5.0%	2.1
Croatia	4.7%	2.8%	6.4%	2.3
Cyprus	4.9%	1.4%	7.8%	5.7
Czech Republic	3.6%	1.8%	5.0%	2.8
Denmark	3.6%	1.6%	5.4%	3.5
Estonia	3.3%	1.3%	5.5%	4.2
Finland	4.2%	2.1%	6.1%	2.9
France	4.4%	2.1%	6.6%	3.1
Germany	4.8%	2.6%	6.8%	2.6
Greece	8.0%	4.1%	10.6%	2.6
Hungary	5.5%	3.5%	7.2%	2.1
Iceland	4.1%	2.3%	5.8%	2.5
Ireland	5.2%	2.4%	7.7%	3.2
Italy	6.7%	3.6%	8.7%	2.4
Latvia	3.9%	2.7%	5.3%	2.0
Lithuania	2.2%	1.1%	3.4%	3.0
Luxembourg	3.2%	1.8%	4.3%	2.4
Macedonia	5.4%	3.5%	6.6%	1.9
Malta	4.4%	1.3%	6.0%	4.8
Netherlands	3.9%	1.9%	5.5%	2.9
Norway	2.2%	1.1%	3.1%	2.8
Poland	4.2%	2.7%	5.4%	2.0
Portugal	5.2%	2.9%	7.1%	2.4
Romania	1.3%	0.7%	1.8%	2.5
Slovakia	3.6%	2.0%	4.8%	2.3
Slovenia	3.8%	2.1%	5.2%	2.5
Spain	5.6%	3.5%	7.2%	2.0
Sweden	**4.0%**	**1.8%**	**5.9%**	**3.3**
Switzerland	5.8%	3.2%	8.0%	2.5
Turkey	5.3%	1.3%	6.9%	5.4
United Kingdom	2.6%	1.5%	3.7%	2.5
United States	2.5%	1.2%	3.6%	3.0
AVERAGE	4.3%	2.2%	5.9%	2.9

Table 2: Sample Overview

Sample is 7,331 Swedish twins who responded to the SALTY survey (we include only respondents who answered all of the relevant questions). Panel A describes the sample. Panel B reports the mean of the dummy variables that we create, based on the survey questions (see Appendix A), to capture different psychological traits. For each trait, we report the mean and its cross-correlation with other traits.

Panel A: Description of Sample

	All Individuals	Women	Men	Men/Women
Full sample	7,331	3,621	3,710	
Fraction of All Individuals		49%	51%	
Self-employed sample	1,198	382	816	
Fraction of Full Sample	16%	11%	22%	2.1
Entrepreneur sample	393	67	326	
Fraction of Full Sample	5%	2%	9%	4.7
Fraction of Self-Employed Sample	33%	18%	40%	

Panel B: Summary Statistics of Innate Traits (all variables are dummies)

	Mean	1	2	3	4	5	6	7	8	9	10	11	12	13
1 RISK-AVERSION	0.62													
2 LOSS-AVERSION	0.82	0.14												
3 AMBIGUITY-AVERSION	0.63	-0.01	0.02											
4 LONG-TERM-TIME-PREFERENCE	0.93	-0.07	-0.01	0.00										
5 NUMERACY	0.45	-0.08	0.00	0.03	0.01									
6 ILLUSION-OF-CONTROL	0.78	-0.08	-0.02	0.08	0.05	0.03								
7 FUNGIBILITY-OF-MONEY	0.95	-0.04	-0.02	0.02	0.03	-0.01	0.02							
8 OPPORTUNITY-COST-AWARENESS	0.13	-0.06	-0.06	-0.01	0.03	0.01	0.00	-0.02						
9 GREED-TOLERANCE	0.36	-0.11	-0.09	0.03	0.00	0.03	0.04	0.05	0.01					
10 TRUST-IN-OTHERS	0.25	-0.03	0.00	0.04	0.05	0.01	0.02	0.04	-0.01	0.01				
11 LOCUS-OF-CONTROL	0.51	-0.08	0.00	0.07	0.05	0.02	0.04	0.05	0.01	0.08	0.11			
12 CIVIC-MINDEDNESS	0.48	-0.09	-0.03	0.05	0.05	0.07	0.05	0.04	0.00	0.07	0.04	0.08		
13 NON-BEHAVIORAL-INHIBITION	0.45	-0.13	-0.04	0.03	0.02	0.03	-0.01	0.06	0.01	0.07	0.15	0.15	0.12	
14 HAPPINESS	0.29	-0.01	0.00	-0.02	-0.01	0.00	-0.01	0.03	-0.01	0.04	0.14	0.08	0.03	0.13

Table 3: Gender and Psychological Traits

Data from SALTY Twin Surveys. Specification 1 is a probit regressions, where the dependent variable is 1 if the individual is a woman, and is 0 if the individual is a man. The pecification includes entrepreneur age fixed effects. Coefficients reflect marginal effects. Residuals are clustered by twin pair. Significance at 1% level marked with ***, at 5% with **, and at 10% with *.

	<u>1</u>
RISK-AVERSION	0.111***
	[0.013]
LOSS-AVERSION	0.057***
	[0.016]
AMBIGUITY-AVERSION	-0.085***
	[0.013]
LONG-TERM-TIME-PREFERENCE	-0.027
	[0.025]
NUMERACY	-0.061***
	[0.012]
ILLUSION-OF-CONTROL	-0.058***
	[0.015]
FUNGIBILITY-OF-MONEY	-0.123***
	[0.029]
OPPORTUNITY-COST-AWARENESS	0.012
	[0.018]
GREED-TOLERANCE	-0.119***
	[0.013]
TRUST-IN-OTHERS	0.130***
	[0.014]
LOCUS-OF-CONTROL	-0.069***
	[0.012]
CIVIC-MINDEDNESS	-0.146***
	[0.012]
NON-BEHAVIORAL-INHIBITION	0.059***
	[0.013]
HAPPINESS	-0.008
	[0.014]
Nr of Observations	7,331
R-squared	0.07
Sample	Full
Fixed Effects	Age
Clustering of Residuals	Twin

Table 4: Entrepreneurship and Psychological Traits

Data from SALTY Twin Surveys. All specifications are probit regressions. The dependent variable is 1 if the individual is an entrepreneur, and is 0 otherwise. Specification 3 includes unreported fixed effect dummies formed based on the coding of each psychological trait. All specifications include entrepreneur age fixed effects. Coefficients reflect marginal effects. Residuals are clustered by twin pair. Significance at 1% level marked with ***, at 5% with **, and at 10% with *.

	1	2	3
FEMALE-GENDER	-0.069***	-0.055***	-0.047***
	[0.005]	[0.005]	[0.005]
RISK-AVERSION		-0.023***	
		[0.005]	
LOSS-AVERSION		-0.005	
		[0.005]	
AMBIGUITY-AVERSION		-0.012**	
		[0.005]	
LONG-TERM-TIME-PREFERENCE		0.002	
		[0.008]	
NUMERACY		0.000	
		[0.004]	
ILLUSION-OF-CONTROL		0.003	
		[0.005]	
FUNGIBILITY-OF-MONEY		0.008	Included as fixed effect dummies formed based on the coding of each trait.
		[0.010]	
OPPORTUNITY-COST-AWARENESS		0.016**	
		[0.007]	
GREED-TOLERANCE		0.019***	
		[0.005]	
TRUST-IN-OTHERS		-0.007	
		[0.005]	
LOCUS-OF-CONTROL		0.011***	
		[0.004]	
CIVIC-MINDEDNESS		0.012***	
		[0.004]	
NON-BEHAVIORAL-INHIBITION		0.017***	
		[0.005]	
HAPPINESS		0.013**	
		[0.005]	
Nr of Observations	7,331	7,331	7,331
R-squared	0.06	0.11	0.15
Sample	Full	Full	Full
Fixed Effects	Age	Age	Age
Clustering of Residuals	Twin	Twin	Twin

Table 5: Entrepreneurship and Psychological Traits, Gender Differences

Data from SALTY Twin Surveys. Specification 1 is a probit regression, and the dependent variable is 1 if the individual is and entrepreneur, and is 0 otherwise. The specification includes "FEMALE-GENDER" (unreported), all variables capturing traits (unreported), and interactions between FEMALE-GENDER and traits (reported). The specification also includes entrepreneur age fixed effects. Coefficients reflect marginal effects. Residuals are clustered by twin pair. Significance at 1% level marked with ***, at 5% with **, and at 10% with *.

	1
Interactions with FEMALE-GENDER:	
RISK-AVERSION	0.012
	[0.010]
LOSS-AVERSION	0.002
	[0.011]
AMBIGUITY-AVERSION	-0.006
	[0.009]
LONG-TERM-TIME-PREFERENCE	0.034
	[0.025]
NUMERACY	0.014
	[0.011]
ILLUSION-OF-CONTROL	0.005
	[0.012]
FUNGIBILITY-OF-MONEY	-0.043*
	[0.022]
OPPORTUNITY-COST-AWARENESS	-0.019**
	[0.008]
GREED-TOLERANCE	0.016
	[0.011]
TRUST-IN-OTHERS	0.019
	[0.013]
LOCUS-OF-CONTROL	-0.001
	[0.009]
CIVIC-MINDEDNESS	0.017
	[0.011]
NON-BEHAVIORAL-INHIBITION	-0.002
	[0.009]
HAPPINESS	0.001
	[0.010]
Nr of Observations	7,331
R-squared	0.12
Sample	Full
Fixed Effects	Age
Clustering of Residuals	Twin

Table 6: Self-employment and Psychological Traits

Data from SALTY Twin Surveys. All specifications are probit regressions. The sample excludes entrepreneurs, and the dependent variable is 1 if the individual is non-entrepreneur self-employed, and is 0 otherwise (i.e., employed). Specification 3 includes unreported fixed effect dummies created based on the coding of each psychological trait. All specifications include entrepreneur age fixed effects. Coefficients reflect marginal effects. Residuals are clustered by twin pair. Significance at 1% level marked with ***, at 5% with **, and at 10% with *.

	1	2	3	Sp. 2, Tab. 4
FEMALE-GENDER	-0.055***	-0.052***	-0.050***	-
	[0.008]	[0.008]	[0.008]	
RISK-AVERSION		-0.023***		-
		[0.008]		
LOSS-AVERSION		0.003		
		[0.010]		
AMBIGUITY-AVERSION		-0.007		-
		[0.008]		
		-0.039**		
		[0.017]		
NUMERACY		0.000		
		[0.008]		
ILLUSION-OF-CONTROL		-0.032***		
		[0.010]	Included as fixed effect dummies formed based on the coding of each trait.	
FUNGIBILITY-OF-MONEY		0.038**		
		[0.015]		
OPPORTUNITY-COST-AWARENESS		0.015		+
		[0.012]		
GREED-TOLERANCE		0.005		+
		[0.008]		
TRUST-IN-OTHERS		-0.021**		
		[0.009]		
LOCUS-OF-CONTROL		-0.003		+
		[0.008]		
CIVIC-MINDEDNESS		0.004		+
		[0.008]		
NON-BEHAVIORAL-INHIBITION		0.001		+
		[0.008]		
HAPPINESS		0.005		+
		[0.009]		
Nr of Observations	7,331	7,331	7,331	
R-squared	0.02	0.02	0.04	
Sample	Full	Full	Full	
Fixed Effects	Age	Age	Age	
Clustering of Residuals	Twin	Twin	Twin	

Robustness Table 1: Gender and Psychological Traits, Robustness of Specification 1 in Table 3

	1	2	3	4	Sp. 1, Tab. 3
RISK-AVERSION	0.121***	0.098***	0.111***	0.107***	**+**
	[0.013]	[0.013]	[0.013]	[0.013]	
LOSS-AVERSION	0.061***	0.051***	0.057***	0.057***	**+**
	[0.016]	[0.016]	[0.016]	[0.016]	
AMBIGUITY-AVERSION	-0.092***	-0.081***	-0.085***	-0.084***	**-**
	[0.013]	[0.013]	[0.013]	[0.013]	
LONG-TERM-TIME-PREFERENCE	-0.04	-0.02	-0.03	-0.027	
	[0.025]	[0.025]	[0.025]	[0.025]	
NUMERACY	-0.064***	-0.054***	-0.061***	-0.060***	**-**
	[0.012]	[0.012]	[0.012]	[0.012]	
ILLUSION-OF-CONTROL	-0.062***	-0.047***	-0.058***	-0.058***	**-**
	[0.015]	[0.015]	[0.015]	[0.015]	
FUNGIBILITY-OF-MONEY	-0.122***	-0.115***	-0.123***	-0.123***	**-**
	[0.029]	[0.029]	[0.029]	[0.029]	
OPPORTUNITY-COST-AWARENESS	0.01	0.01	0.01	0.013	
	[0.018]	[0.018]	[0.018]	[0.018]	
GREED-TOLERANCE	-0.126***	-0.114***	-0.119***	-0.118***	**-**
	[0.013]	[0.013]	[0.013]	[0.013]	
TRUST-IN-OTHERS	0.122***	0.132***	0.130***	0.131***	**+**
	[0.014]	[0.014]	[0.014]	[0.014]	
LOCUS-OF-CONTROL	-0.078***	-0.059***	-0.069***	-0.068***	**-**
	[0.013]	[0.013]	[0.012]	[0.012]	
CIVIC-MINDEDNESS	-0.150***	-0.140***	-0.146***	-0.142***	**-**
	[0.012]	[0.012]	[0.012]	[0.012]	
NON-BEHAVIORAL-INHIBITION	0.055***	0.068***	0.059***	0.060***	**+**
	[0.013]	[0.013]	[0.013]	[0.013]	
HAPPINESS	-0.01	0.00	-0.01	-0.007	
	[0.014]	[0.014]	[0.014]	[0.014]	
YEARS-EDUCATION	0.014***				
	[0.003]				
ANNUAL INCOME (1996-2000)		-0.112***			
		[0.024]			
MARRIED-DUMMY			0.00		
			[0.013]		
NUMBER-OF-CHILDREN				-0.036***	
				[0.008]	
Estimation Technique	Probit	Probit	Probit	Probit	
Nr of Observations	7,340	7,340	7,340	7,340	
R-squared	0.07	0.09	0.07	0.07	
Sample	Full	Full	Full	Full	
Fixed Effects	Age	Age	Age	Age	
Clustering of Residuals	Twin	Twin	Twin	Twin	

Robustness Table 2: Entrepreneurship and Psychological Traits, Robustness of Specification 2 in Table 4

	1	2	3	4	5	Sp. 2, Tab. 4
FEMALE-GENDER	-0.055***	-0.054***	-0.054***	-0.054***	-0.055***	**-**
	[0.005]	[0.005]	[0.005]	[0.005]	[0.015]	
RISK-AVERSION	-0.023***	-0.023***	-0.023***	-0.023***	-0.016	**-**
	[0.005]	[0.005]	[0.005]	[0.005]	[0.013]	
LOSS-AVERSION	-0.01	-0.01	-0.01	-0.01	0.006	
	[0.005]	[0.005]	[0.005]	[0.005]	[0.015]	
AMBIGUITY-AVERSION	-0.012***	-0.012**	-0.012***	-0.012**	-0.025**	**-**
	[0.005]	[0.005]	[0.005]	[0.005]	[0.010]	
LONG-TERM-TIME-PREFERENCE	0.00	0.00	0.00	0.00	-0.01	
	[0.008]	[0.008]	[0.008]	[0.008]	[0.018]	
NUMERACY	0.00	0.00	0.00	0.00	0.006	
	[0.004]	[0.004]	[0.004]	[0.004]	[0.012]	
ILLUSION-OF-CONTROL	0.00	0.00	0.00	0.00	0.002	
	[0.005]	[0.005]	[0.005]	[0.005]	[0.013]	
FUNGIBILITY-OF-MONEY	0.01	0.01	0.01	0.01	-0.017	
	[0.010]	[0.010]	[0.010]	[0.010]	[0.019]	
OPPORTUNITY-COST-AWARENESS	0.016**	0.015**	0.016**	0.015**	0.017	**+**
	[0.007]	[0.007]	[0.007]	[0.007]	[0.018]	
GREED-TOLERANCE	0.019***	0.019***	0.019***	0.019***	0.018	**+**
	[0.005]	[0.005]	[0.005]	[0.005]	[0.012]	
TRUST-IN-OTHERS	-0.01	-0.01	-0.01	-0.01	0.021*	
	[0.005]	[0.005]	[0.005]	[0.004]	[0.012]	
LOCUS-OF-CONTROL	0.011***	0.011***	0.011***	0.011***	0.035***	**+**
	[0.004]	[0.004]	[0.004]	[0.004]	[0.012]	
CIVIC-MINDEDNESS	0.012***	0.012***	0.011**	0.011***	0.027**	**+**
	[0.004]	[0.004]	[0.004]	[0.004]	[0.012]	
NON-BEHAVIORAL-INHIBITION	0.016***	0.017***	0.016***	0.016***	0.008	**+**
	[0.005]	[0.005]	[0.005]	[0.005]	[0.012]	
HAPPINESS	0.012**	0.013**	0.011**	0.012**	0.012	**+**
	[0.005]	[0.005]	[0.005]	[0.005]	[0.013]	
YEARS-EDUCATION	0.000					
	[0.001]					
ANNUAL INCOME (1996-2000)		0.00				
		[0.003]				
MARRIED-DUMMY			0.009**			
			[0.004]			
NUMBER-OF-CHILDREN				0.003		
				[0.002]		
Estimation Technique	Probit	Probit	Probit	Probit	OLS	
Nr of Observations	7,340	7,340	7,340	7,340	7,340	
R-squared	0.11	0.11	0.11	0.11	0.03	
Sample	Full	Full	Full	Full	Full	
Fixed Effects	Age	Age	Age	Age	Age, Twin	
Clustering of Residuals	Twin	Twin	Twin	Twin	None	