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# Luck and Entrepreneurial Success

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# Luck and entrepreneurial success<sup>◊</sup>

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## Abstract

How much of entrepreneurial performance is sheer luck compared to talent, experience, education, and hard work? We define luck as unexpected performance and look for an answer in a large survey of entrepreneurs. Accordingly, luck ranks last in importance among various success factors and accounts for less than one third of performance variation. This ranking is unaffected by past performance and many personality traits, including self-attribution and illusion of control. Luck matters, however, in activities such as finding the appropriate business idea or choosing the right moment to enter a market. More important, luck perceptions shape decisions. For example, individuals who believe luck is important are reluctant to become entrepreneurs. Consistent with the definition, what entrepreneurs believe is luck correlates with the unexplained variation in a standard econometric model of performance. Estimates of that model also show that hard work does affect performance. So do talent, education, and, especially, experience.

Keywords: luck, start-ups, entrepreneur, factors of success, performance

JEL codes: G3, G02, M13

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*Those who have succeeded at anything and don't mention luck are kidding themselves.*

Larry King, American television and radio host

## **1 Introduction**

How much is luck as opposed to skill in life is an old, intriguing question. In his *Tusculanae Disputationes*, for example, Cicero concluded that “fortune, not wisdom, rules lives.” The issue has fascinated people in all facets of human life. Philosophers and religious leaders, for example, have debated the importance of human free will versus divine predestination. Not surprisingly, the question comes up almost every day, for instance, in reaction to exceptional performance in sports and business. Are some of Roger Federer’s most memorable shots just fortuitous or the expression of his talents? Was it luck that enabled entrepreneurs, like Sam Walton, Colonel Sanders, Bill Gates, and Michael Dell to go from tiny operations to extraordinary success? Was it skills or luck that propelled the success of Peter Lynch as a fund manager?

The current literature approaches the question of the importance of luck by studying whether skills play a significant role in performance (e.g., Gompers, Kovner, Lerner, and Scharfstein (2010), Kaplan, Klebanov, and Sorensen (2012)). This paper differs from the standard approach by assessing the importance of luck directly with an investigation into what entrepreneurs themselves believe. The justification is that, ultimately, it is opinions and beliefs that determine behavior (see, for example, Baum, Locke, and Smith (2001) or Hmieleski and Baron (2009)).

Implicitly, the literature defines luck as the unexpected and therefore unpredictable component of performance. Bertrand and Mullainathan (2001), for example, define it as

“observable shocks beyond the CEO’s control” (p. 901). Kahneman (2011) talks about “factors that the CEO does not control” (p. 205). We use the literature’s definition.

To the best of our knowledge, this is one of the first large-scale empirical studies to attempt an appraisal of the importance of luck in entrepreneurial performance. One significant exception is Gompers, Kovner, Lerner, and Scharfstein (2010). According to that paper, successful entrepreneurs have persistent market timing abilities as opposed to sheer luck. In the corporate finance literature, Chang, Dasgupta, and Hilary (2010) find that CEOs’ abilities contribute to firm performance over and above the effects of firm-specific assets and luck. Other studies have analyzed the influence of luck on executive pay (e.g., Fama (1980), Bertrand and Mullainathan (2001)). The issue of luck versus skills in performance is much more popular in the investment literature, starting with Fama, Fisher, Jensen, and Roll (1969). More recently, Kosowski, Timmermann, Wermers, and White (2006) concluded that a significant minority of mutual funds have skills that allow them to outperform, while Fama and French (2010) maintain that most of the variation in mutual fund alpha is driven by luck.

The basis for our investigation is a 2007 survey of 63,202 individuals in Switzerland. According to various indices, Switzerland ranks internationally at the very top in terms of innovation, entrepreneurial performance, and competitiveness. The *Global Innovation Index 2013*, published jointly by Cornell University, INSEAD, and the World Intellectual Property Organization (an agency of the UN), for example, assigns Switzerland the top spot as the most innovative nation. Similarly, the *OECD Factbook 2011-2012* places Switzerland at the top of the international rankings for patents relative to total population. Switzerland is also at the forefront in terms of entrepreneurship. The *Global Entrepreneurship and Development Index 2012*, issued by the Imperial College Business School in the UK, puts it on third place behind the

US and Australia in terms of entrepreneurial activity. Finally, Switzerland is one of the most competitive economies in the world. In particular, it tops the overall rankings of the *Global Competitiveness Report 2012-2013*, which is published by the World Economic Forum. Hence, Switzerland would seem to be an attractive place to investigate entrepreneurial motivations and performance. At the same time, with its three main regions (German, French, and Italian), it also provides the opportunity for inter-cultural comparisons.

8,245 individuals completed the questionnaires we sent out. About one third of them were entrepreneurs who had registered their businesses between 2002 and 2006, the rest were non-entrepreneurs, including teachers, engineers, managers, and public employees. The characteristics of this sample of entrepreneurs are similar to those of the sample in Bitler, Moskowitz, and Vissing-Jørgensen (2005). Consistent with prior studies (e.g., Evans and Leighton (1989)), we find that entrepreneurs are markedly different people. Compared with non-entrepreneurs, they are more likely to be male and a bit younger, are less risk averse and more overconfident, and have the same management experience but shorter industry experience.

We start our investigation using a model of expected entrepreneurial performance similar to that in Bitler, Moskowitz, and Vissing-Jørgensen (2005) and Gompers, Kovner, Lerner, and Scharfstein (2010). When we regress industry-adjusted sales on various proxies for skills, personal characteristics, and firm characteristics, we find that luck (the residual component) could be responsible for about 60% of performance. Our regression coefficient estimates are consistent with many of the results reported in the literature with secondary data, giving us comfort that our survey provides reliable inferences. However, the measure of residual performance is likely an upper bound on the importance of pure chance since we do not know the correct model of performance nor the most appropriate proxies for its determinants. Still, we

can use this measure of residual performance to validate the subjective assessment of luck used in the survey. As it turns out, the two measures are positively related.

To avoid the model specification problem, we therefore ask respondents to rank the importance of six different potential determinants of firm performance, namely experience, talent, hard work, education, connections, and luck. These rankings yield a subjective measure of the importance of luck. We find that entrepreneurs believe luck is a less important explanatory factor of performance variation than the other five are. Based on the results of a principal components analysis, we conclude that luck explains at best one third of entrepreneurial performance variation.

Perceptions, however, could be colored by personal history and characteristics. Successful entrepreneurs could be blinded by their achievement and, in their self-attribution bias, assign a lesser role to luck than it deserves. Similarly, personal traits such as overconfidence (e.g., Hmieleski and Baron (2009)), risk aversion (Zhao and Seibert (2006)), and illusion of control (Langer (1975)) might bias beliefs. Not surprisingly, we find that behavioral biases do affect people's assessments. However, none of the many behavioral biases we analyze affects the *ranking* of luck among the six factors considered. Luck is always the least important factor. This holds also regardless of cultural background and religion. To test whether entrepreneurs simply have a distorted view of reality, we also ask non-entrepreneurs. Yet their responses lead to very similar inferences—namely that luck is the least important of the six success factors examined.

As a further test of self-attribution bias, we asked respondents how important luck is in individual entrepreneurial activities. According to their answers, gaining customers, finding the business idea, and establishing business connections are activities in which luck plays a very

important role. In contrast, finding suppliers and securing sources of financing are activities that are comparatively less dependent on luck. More importantly, close to 60% noted that luck plays a very significant role in at least one of these activities. This finding is inconsistent with self-attribution being the reason why luck is given comparatively little importance in overall performance.

We then investigate whether perceptions shape decisions and find that the assessment of the importance of luck does affect behavior. Impressions, as we measure them, matter. Individuals who believe luck is an important determinant of performance tend to shy away from an entrepreneurial career, consistent with the experimental results in Camerer and Lovo (1999). Moreover, these individuals are: (a) less willing to tap their pension plans to fund their firm; (b) less inclined to work full-time for their firm; and (c) more predisposed to recognize the real-option implications of luck.

Finally, in a rough test of consistency of what entrepreneurs tell us, we test whether luck perceptions correlate with the unexplained variation in our regression model of performance. We find that what entrepreneurs believe is good luck correlates positively and significantly with unexpected variation, and what is believed to be bad luck correlates negatively with that variation. This suggests that luck to entrepreneurs is indeed unexpected performance. We also find that other perceived factors of success, in particular hard work and experience, make indeed a positive contribution to actual performance.

Various biases can affect a survey, even though we designed ours in such a way as to limit their influence. We performed a battery of tests to assess the presence of bias. We found no evidence of significant non-response, self-selection, or survivorship bias. There is also no reason

to believe that our sample of entrepreneurs is not representative of the population. Moreover, the regression results are compatible with those reported in the literature that uses non-survey data.

This study contributes to a better understanding of entrepreneurs, their motivations, and their decisions. If entrepreneurs believed success were mostly a random event (as in Kihlstrom and Laffont (1979)), individuals with high self-assessed skills would probably be discouraged from opting for an entrepreneurial career (Camerer and Lovallo (1999)). We find that entrepreneurs rank luck last among factors of success by far regardless of personal history and characteristics. One possible reason is that entrepreneurs, on average, do not generally pursue radically new ideas but replicate or modify successful ideas seen in previous employment (Bhidé (2000)). Second, we show that perceptions about the importance of luck matter when making decisions. We therefore contribute to the literature that documents the importance of behavioral aspects in managerial behavior. Third, we find little evidence of irrationality. What appears random to entrepreneurs is indeed random. Finally, and related, the evidence shows not only that commitment, hard work, and dedication can overcome sheer luck in the mind of entrepreneurs, but that many of these factors have a real impact. These findings suggest ways to nurture entrepreneurship and, ultimately, economic growth. They should therefore be of interest to educators, investors, policymakers, and regulators alike.

The rest of the paper proceeds as follows. The next section discusses the sample and its characteristics. Section 3 estimates the unexpected component in a model of entrepreneurial performance, an approach that provides us, in principle, with an impersonal measure of luck. Section 4 then surveys beliefs, which yields a subjective assessment of the importance of luck. The section also performs various tests to assess the possible bias in those beliefs. Section 5 focuses on self-attribution bias and examines whether entrepreneurs assign luck a minor role also



in various individual management activities. Section 6 asks whether luck perceptions affect the entrepreneurial decision. Section 7 investigates how those perceptions shape the decision making of entrepreneurs. Section 8 studies the relation between luck perceptions and unexplained performance. Finally, Section 9 concludes.

## **2 Sample description and characteristics**

### *2.1 Sample selection*

The survey was conducted in Switzerland at the end of 2007. Two questionnaires were used: one for entrepreneurs and one for a control group of managers and employees (both questionnaires can be downloaded from the Internet at <http://www.ifm.unibe.ch/>). Following Bitler, Moskowitz, and Vissing-Jørgensen (2005) and Landier and Thesmar (2009), entrepreneurs are individuals with an equity participation in the firm they work for. The narrower definition by Gompers, Lerner, and Scharfstein (2005) that requires that entrepreneurs also be the firm's founders or cofounders was used as well. Unless explicitly stated, the analysis uses the broader definition. The results go through with either definition.

In designing the survey, we followed the procedure suggested by Graham and Harvey (2001). Specifically, we first examined other questionnaires on entrepreneurship. Based on those questionnaires and a careful review of the existing literature, we drafted a first version in German and circulated it among a group of academics for feedback. We revised the questionnaire on the basis of their critique and suggestions. Then we sought the advice of marketing and psychology scholars on survey design and execution. In particular, we discussed measures to increase the response rate and minimize possible response biases. Thereafter, we sent the questionnaire to a group of entrepreneurs and managers for a pretest. Having revised the

questionnaire based on their suggestions, we asked a communication specialist to look over the design and wording of the questionnaire. Finally, we discussed the reworked document with several entrepreneurs and managers to make sure every question was understandable.

The questionnaire for entrepreneurs was sent to 40,000 randomly selected chairmen of the board, joint owners of companies with limited liability, and sole proprietors of start-ups. Their names were taken from the Swiss Commercial Register. To make sure these individuals remembered the information we were seeking, we focused on recently founded firms, namely those founded in 2002, 2004, and 2006. To ensure a balanced random sample of firms, we applied stratified sampling with starting year and legal form as strata. The questionnaire focused on seven topics: company founding, current company data, professional background and education, personal characteristics, relative importance of luck, social environment, and personal financial circumstances. The document was nine pages long and contained 54 questions, most of them with subparts.

The questionnaire for the control group contained the same questions except for the two company-related sections and for three additional questions: one about the profession, one about the current employer, and one to find out whether the respondent ever founded a company. The questionnaire for the control group was six pages long; it contained 26 questions, most of them with subparts. It was sent to 23,202 individuals, namely managers and other employees (public employees, teachers, engineers, mechanics, and commercial clerks) randomly picked from the official Swiss telephone guide. For this sample, we used profession as strata. Both questionnaires promised strict anonymity. Because Switzerland has three official languages, each questionnaire had a German, a French, and an Italian version.<sup>1</sup>

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<sup>1</sup> In the German version, the term for luck was “Zufall” (as opposed to “Glück,” which corresponds to good luck). In the French version, it was “hasard,” and in the Italian version, it was “caso.”

To increase the response rate, a cover letter and a postage-paid return envelope were included. As a further incentive to participate, respondents could order an analysis report. After two weeks, people were sent a reminder, and those who had misplaced the questionnaire were given the possibility of obtaining a new copy by physical mail or e-mail, or from a Web site that was created for that purpose. Over 300 individuals ordered a second copy. We also set up a telephone hotline to answer questions.

A total of 8,245 individuals filled out one of the two questionnaires. The response rate of more than 13% is slightly larger than the 7%-12% reported in surveys of CFOs (Trahan and Gitman (1995), Graham and Harvey (2001), Brav, Graham, Harvey, and Michaely (2005)), but a bit lower than the 16%-19% reported in other surveys of entrepreneurs (Bosma, Van Praag, Thurik, and De Wit (2004) and Forbes (2005)).<sup>2</sup> Of the 8,245 respondents, 3,099 were entrepreneurs according to the broader definition, 2,778 were entrepreneurs according to the more restrictive definition, and 5,141 were individuals from the control group. 4,410 individuals filled out the questionnaire completely.

< Insert Table I here >

Table I examines how representative the sample of entrepreneurs is compared to the overall population of firms in the Swiss Commercial Register in terms of founding year and legal form. The questionnaire was sent to 53% of the firms founded in each type of legal form in each sample year. For each year, the table computes the fraction of the number of firms in the population that was founded in each type of legal form (column (4)). The same computation is repeated for the fraction of the responding entrepreneurs (column (8)). Column (9) compares sample and population proportions. The deviations are almost always smaller than 0.6 percent.

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<sup>2</sup> Hmieleski and Baron (2009), however, achieve a response rate of 24.8% in their survey of 1,000 new ventures drawn from Dun and Bradstreet.

The exceptions are corporations in 2004 with 3 percent sample underrepresentation, and companies with limited liability (LLCs) in 2006 with 2.5 percent sample overrepresentation. Still, we cannot reject the hypothesis that the sample is representative of the population of entrepreneurs.

The control sample does not always match the population as closely as the treatment sample does (not shown in a separate table). In the case of employees, public employees, engineers, and teachers, the individuals in our sample are fairly representative of their category as listed in the telephone guide—the deviations are 0.1 percent, -4 percent, 4 percent, and 11 percent, respectively. In the case of mechanics, however, the deviation is 16 percent (mechanics are only 11 percent of the control sample). As for the representativeness of managers, it is more difficult to assess, since they cannot be clearly identified from the telephone guide (someone listed as an engineer might simply be disclosing his educational background rather than the fact that he is a manager).

To maximize the number of observations in the regression analysis, whenever there are missing data, we use nondisclosure dummies (see, for example, Himmelberg, Hubbard, and Palia (1999)). These binary variables equal one if a given respondent does not disclose a particular piece of information, and zero otherwise; the variable itself is given a value of zero for the respondents who don't provide the information in question. All the descriptive statistics and the univariate analysis, however, reflect only the reported data.

## *2.2 Sample description*

Eighty-nine percent of the entrepreneurs founded their firm, 4 percent inherited it, and the rest bought it from someone else. In 78 percent of the cases, the firm was funded initially by the

founder alone. Initial equity financing was as follows: 87 percent by the founder himself, 9 percent by family and friends, 1 percent by strategic investors, and 1 percent by business angels or venture capitalists.

Table II reports descriptive statistics about the entrepreneurs and their companies. About 44 percent of the firms are sole proprietorships, 31 percent are LLCs, and 24 percent are corporations. Robb and Robinson's (2012) study of new businesses started in 2004 in the U.S., as covered in the *Kauffman Firm Survey*, is fairly similar: 36 percent sole proprietorships, 31 percent LLCs, and 28 percent corporations (the remaining 5.7 percent are partnerships). Swiss LLCs have a minimum capital of CHF 20,000 (the exchange rate was about CHF 1.02 to the USD at the time of the survey); all their owners participate in firm management. As for corporations, Swiss corporations have many of the same characteristics as U.S. corporations do, except for a minimum capital requirement of CHF 100,000 (at least half of it paid in). In the US, corporations have no minimum capital requirement. The median equity capital in the sample is 118 thousand.

By construction, our sample firms are fairly tiny. Including the entrepreneur, the median company in our sample began with one employee, the average with 3, and the largest with 330. By the time they appeared in the sample, these firms had grown somewhat. The median sample company has 2 employees, the average 5.6, and the largest 1,190. As shown further down in Table IV, the sample of US entrepreneurs in Bitler, Moskowitz, and Vissing-Jørgensen's (2005) has very similar size characteristics. And so does the study by Robb and Robinson (2012) mentioned above. Even if the U.S. has several huge firms, many of them, including Hewlett-Packard, Pizza Hut, or Kentucky Fried Chicken started out as very small operations.

< Insert Table II here >

In line with Bitler, Moskowitz, and Vissing-Jørgensen (2005), entrepreneurs hold a large fraction of the firm's equity. The median ownership is 100 percent and the lower quartile 80 percent. A restricted number of entrepreneurs have less than 20 percent ownership. The reason is that they might be presidents but not founders. Alternatively, they might have divested much of their business already. Our results are robust to excluding these few observations. As it turns out, 74 percent of the proprietorships claim to have no debt at all, compared to 66 percent in LLCs, and 59 percent in corporations (not shown). Sixty firms in the sample, about 2 percent, have VC or business-angel financing. This is higher than the 0.1 percent reported in Asker, Farre-Mensa, and Ljungqvist (2011) for the U.S.

Twenty-nine percent of the entrepreneurs work part-time for their firm, and 4 percent were unemployed before starting. Moreover, 27 percent are repeat entrepreneurs. Of these, 76 percent claim to have been successful and 24 percent unsuccessful before. Ninety-one percent have previously worked for a firm (not shown). The companies that acted as incubators are fairly evenly distributed across firm size: 24 percent of the entrepreneurs worked for companies with more than 250 employees, and 29 percent for companies with fewer than 10 employees (not shown).

Based on what respondents say, our sample firms are in 13 different industries (not shown). Most companies are either in IT or commerce (17 and 16 percent, respectively), the fewest are in agriculture and energy (2 and 1 percent, respectively).

To measure performance, and in keeping with Bitler, Moskowitz, and Vissing-Jørgensen (2005), we computed the industry- and formation-year-adjusted logarithm of sales for the year 2006. Average sales are about CHF 2 million, with a minimum of zero and a maximum of CHF 2.5 billion. To minimize the impact of potential outliers, we winsorize our performance metric at

the 1<sup>st</sup> and 99<sup>th</sup> percentiles of its distribution. Moreover, consistent with Bitler, Moskowitz, and Vissing-Jørgensen (2005), we exclude all firms with zero sales in the regression analysis.

Table III provides comparative statistics for entrepreneurs and non-entrepreneurs grouped in three categories: a) entrepreneurial characteristics, b) personal characteristics, c) and firm-specific variables. Variable definitions are in the Appendix.

< Insert Table III here >

Consistent with prior studies (e.g., Evans and Leighton (1989)), entrepreneurs are different people. Economically, however, the differences are limited to only a few dimensions. Specifically, entrepreneurs have shorter work (24 vs. 31 years) and industry (15 vs. 22 years) experience. Moreover, they are younger (45 versus 54 years), less risk averse and more overconfident, and they tend to be male (women are 18 percent). But there is little actual difference in terms of, for example, management experience, education, connections, or net wealth.

As mentioned above, our sample is comparable with that of Bitler, Moskowitz, and Vissing-Jørgensen (2005). As shown in Table IV, the vast majority of entrepreneurs in both samples are male, in their 40s, and own more than 80 percent of their firm's equity. The firms themselves have an average number of 6 employees in our sample, compared to between 8 and 10 in Bitler, Moskowitz, and Vissing-Jørgensen (2005). Similarly, average sales are CHF 2 million in our sample, compared with between 0.7 and 0.9 million in their sample.

< Insert Table IV here >

### 2.3 *Non-response, survivorship, and self-selection bias*

To examine the presence of non-response bias in the data, we compared the answers of early respondents with those of late respondents. Filion (1975) argues that late respondents resemble non-respondents. We did this for each of the 27 variables in the survey. According to a Wilcoxon rank-sum test, early answers differed from late answers for 12 of the 27 variables with confidence 0.95 (not tabulated). Yet the differences were mostly related to firm characteristics, not to luck perceptions, education, experience, and personal characteristics. We replicated the subsequent analysis for early and late respondents, separately. The conclusions were unaffected.

There could also be survivorship bias in the data, for unsuccessful firms eventually cease to exist and cannot be surveyed. Based on data from the *Bundesamt für Statistik und Unternehmensdemographie* (the official statistical department in Switzerland), it is known that 80.7 percent of the firms that are started at any time are still operating one year later, 69.8 percent after two years, and only 50.0 percent after five. We obtain qualitatively the same results, however, when focusing only on entrepreneurs that started their firm at the end of the sample period, namely in 2006. If survivorship had biased the results, the problem would have been less severe in this cohort of firms, since they didn't have much time to disappear before we conducted the survey.

Another problem could be self-selection bias. It is possible that entrepreneurs of unsuccessful firms are less likely to participate in a survey. Yet we do not believe this issue poses a significant problem. First, close to 20 percent of the sample firms actually report negative earnings during the sample period, which was characterized by positive overall economic growth. Second, we checked whether early respondents differ from late respondents with respect to profitability. If unsuccessful entrepreneurs were hesitant to participate, and if late



respondents were similar to non-respondents, then late respondents should be less profitable than early respondents. Yet mean and median comparison tests rejected this hypothesis (not shown). Third, even if there is some self-selection bias, the following analysis will show that the subjective rankings of success factors, the main variable of interest here, do not depend on performance.

There were two further concerns. One was that respondents might not answer truthfully. We cannot exclude that. However, the nature of the questions in the survey does not seem to be particularly confidential. More importantly, our results are similar to those reported in the literature. The second concern was that the respondents might not have understood the survey questions. This issue was addressed in three different ways. First, wherever possible, we used questions from past surveys in the literature. Second, the questions were pre-tested with a diverse sample of entrepreneurs and employees. Third, respondents were asked to indicate which questions were hard to understand. Only 9 percent did so. Dropping these individuals from the sample had no material effect on the conclusions (not shown).

### **3 Luck as unexplained performance**

The first step in our analysis is the estimation of a standard model of entrepreneurial performance. The unexplained component of that performance is our first measure of entrepreneurial luck.

### 3.1 *The performance regression*

The entrepreneurial performance model we use borrows from the entrepreneurship literature (see, among others, Bitler, Moskowitz, and Vissing-Jørgensen (2005) and Gompers, Kovner, Lerner, and Scharfstein (2010)). Formally, we estimate the following cross-sectional regression:

$$\text{Performance}_i = g(\text{entrepreneurial skills, personal characteristics, firm-specific control variables})_i + \varepsilon_i, \quad (1)$$

where  $\varepsilon_i$  is a disturbance term with the standard properties, and the subscript refers to firm  $i$  in the sample. In keeping with the literature, the functional form  $g(\cdot)$  is linear, although the results are robust to various nonlinearities and interaction terms.

Because entrepreneurs are unlikely to be drawn from a random sample of individuals, we perform the analysis with a Heckman (1979) two-stage estimation procedure. Entrepreneurs might possess unobserved characteristics related to entrepreneurial performance, a situation that could bias the estimates of equation (1) (Hamilton (2000)). To correct for this potential sample selection problem, we first model the decision of pursuing an entrepreneurial career. The first-stage regression is therefore the following probit regression:

$$\text{Entrepreneur}_i = f(\text{entrepreneurial skills, personal characteristics, identification variables})_i + v_i, \quad (2)$$

where  $v_i$  is a standard disturbance term, and *entrepreneur* is a binary variable equal to one if the individual,  $i$ , in question is an entrepreneur, and zero otherwise. In the second stage, we estimate the performance regression (1) with the addition of the inverse mills ratio from the first stage as a regression argument. The specification of the selection function  $f(\cdot)$  in regression (2) above is

linear and based on the review of the literature in Parker (2004) and the hypotheses formulated in Blanchflower and Oswald (1998), Holtz-Eakin, Joulfaian, and Rosen (1994a), and Sørensen (2007). Although the non-linearities of the probit model might already fulfill the exclusion restrictions (Wooldridge (2002), Li and Prabhala (2007)), we include a number of identification variables. A first identification variable, *career by chance*, is a binary variable that identifies entrepreneurs who claim to have chosen their career accidentally. Two other variables are *motivation achievement*, a psychological trait often mentioned in the management literature (Zhao and Seibert (2006)) and *net wealth* (e.g. Holtz-Eakin, Joulfaian, and Rosen (1994a)). Finally, we use two variables from the social capital theory, namely size of the previous employer, as captured by the variable *previously employed in a small firm* (Gompers, Lerner, and Scharfstein (2005), Sørensen (2007)), and a binary variable that identifies entrepreneurs with *entrepreneurial parents* (Blanchflower and Oswald (1998)). All these variables have been shown to affect the career decision of entrepreneurs.

### 3.2 Estimation results

Table V reports a summary of the estimation results. To save space, we do not report individual regression coefficients because they will be shown and discussed in detail further down (Tables 13 and 15). Column (1) refers to the first stage of the Heckman procedure. There are 7,495 observations, of which 2,349 are entrepreneurs and 5,146 are non-entrepreneurs. The McFadden's adjusted R-squared is 27%; 76% of the observations are correctly predicted.

< Insert Table V here >

The second stage of the Heckman procedure, shown in column (2), yields a measure of unexpected performance, and hence our first measure of luck. There are 2,349 observations for that regression, fewer than the total number of sample entrepreneurs, as not all respondents provide sales and other firm-specific data. The model explains 37.8 percent of the cross-sectional variation in industry-adjusted performance. Assuming the model is correct, luck would therefore be responsible for 62.2 percent of the cross-sectional variation in sales. If so, performance would seem to be for the most part a reflection of luck. However, given that we don't know the correct model of performance nor the correct proxies to measure its determinants, this is probably an upward biased assessment. Still, this estimate of luck will subsequently help us validate our subjective measure of luck.

#### **4 Luck perceptions**

To obtain that subjective measure, the survey posed the following question: “*How important are the following aspects for business performance: luck, experience, talent, hard work, education, and connections?*” Respondents could score these factors from *very important* (5) to *quite unimportant* (1). They could give the same score to different factors. For example, they could give all factors a 2, if they thought they were all fairly unimportant. Since scores are subjective, they are not necessarily comparable across respondents. We therefore rely on the scores provided by each respondent to infer his/her rankings of the various factors and perform the analysis with those rankings. A ranking of 1 is assigned to the factor with the highest score, and, in the limit, a ranking of 6 to the factor with the lowest score. Our conclusions, however, are unaffected when we rely on the scores instead.

Participants were asked to mention other possible factors besides the six suggested. Only nine out of every 100 respondents took advantage of that possibility. They mentioned things like confidence, stamina, and family support. However, there was no consensus on any one of these additional factors. Hence, we assume that the six factors in the question are exhaustive. This is a conservative assumption, as it limits the number of factors that could potentially rank ahead of luck to five.

#### *4.1 Rankings of success factors*

Table VI details the answers from the approximately 3,000 entrepreneurs. Panel A provides summary statistics. With a median rank of 5, luck places far behind the other factors. In comparison, hard work, experience, and talent have a median rank of 1, and education and connections one of 2. Panel B indicates that only about 15 percent of the respondents think luck is the most important key to success, whereas as many as 78 percent regard it as the least important. Hard work comes out on top of the rankings—about 75 percent of the entrepreneurs in the sample consider it the most important key to success, and only 15 percent believe it is the least important. Talent places very close to hard work. Experience ranks third, whereas education and connections rank lower, although considerably ahead of luck.

< Insert Table VI here >

We also asked the question: “*Can a start-up be financially successful without lucky random events?*” Possible answers were yes, in part, and no. We report the percentage that answered with yes. Even though this question focuses on the upside of performance, people who believe luck is very important overall should also tend to believe that there is no success without luck.

The evidence supports this contention. The relation is positive and the chi-squared test highly significant (not shown).

The obvious reservation about the rankings we just discussed is that they are self-reported opinions—and opinions are bound to be colored by personal circumstances. In what follows, we therefore test whether these personal circumstances could have biased those opinions. The analysis is conducted in Table VII.

#### *4.2 Analysis of scoring bias*

Causal attributions have been found to serve the need to protect and/or enhance self-esteem (Zuckerman (1979)). If so, successful entrepreneurs might ascribe their success to superior abilities and planning, whereas unsuccessful entrepreneurs might blame their failure on bad luck. We therefore test whether self-attribution bias affects the rankings of luck.

To carry out the test, we split the sample according to various dimensions of performance. First, we focus on actual performance (Panel A). Well-performing firms have sales above the median in the group of peer firms with the same age and in the same industry; the remaining firms tend to be poorly performing. The evidence rejects the hypothesis. With a sizable distance, luck ranks last among the six factors of success, regardless of firm performance. The relative ranking of the remaining five factors is also almost identical across subsamples. Hard work, talent, and experience are slightly more important than education and connections. The only difference we find is that entrepreneurs from firms that do better believe a bit more strongly that they do not need luck to succeed—the corresponding proportions are 62 percent among successful firms compared with 55 percent among unsuccessful ones.

The results are similar when splitting the sample into firms that, in the opinion of their entrepreneurs, have performed worse than anticipated, as anticipated, or better than anticipated. Along the same lines, we also sorted the sample by whether the entrepreneur is a first-time entrepreneur, and, if he is not, by whether the venture was successful or unsuccessful. The conclusions remain the same (not shown). In general, we find no evidence that performance induces a self-attribution bias significant enough to affect the ranking of luck as a success factor.

However, there could be other biases. We test whether entrepreneurs with an internal locus (illusion) of control, i.e., people who believe they have their life under control (see, e.g., Langer (1975)), score the importance of luck differently. Consistent with that, the results in Panel B of Table VII indicate that locus of control does affect beliefs. In particular, a large fraction (69%) of entrepreneurs with an illusion of control does not believe that it takes luck to be successful. That compares with only 55% of the entrepreneurs with an external locus of control. However, when it comes to ranking success factors, both subsamples assign luck the lowest rank. The ranking of the other performance factors is similar across subsamples as well.

< Insert Table VII here >

Panel C of Table VII examines the importance of cultural differences. As mentioned, the entrepreneurs in our sample operate in three different areas: a German, a French, and an Italian one. There are substantial differences in the way of looking at things and in communicating among these particular cultures. For example, the French tends to be a high context culture, where fewer things are fully spelled out (Hall and Hall (1990)). In contrast, the German culture tends to be the opposite. There are also cross-cultural differences in risk perception (Weber and Hsee (1998)). The panel, shows that there are indeed significant differences in the assessment of the relevance of luck per se. Almost 60 percent of the entrepreneurs with a German background

think they don't need luck to succeed, compared with 53 percent among entrepreneurs with a French background, and only 44% among entrepreneurs with an Italian background. As it turns out, there are also differences in the importance (but not the ranking) of the other success factors. Hard work, in particular, is given more importance among entrepreneurs in German-speaking Cantons compared to those in French-speaking Cantons and, especially, those in Italian-speaking Cantons. In spite of all these differences, however, luck ranks always last among success factors regardless of cultural background.

We also investigated the effect of the two main religions in Switzerland, the Protestant and the Catholic. Protestants tend to embrace the idea of predestination, whereas Catholics follow the doctrine of free will. If so, Protestants will be inclined to downplay the role of luck. Panel D therefore sorts the entrepreneurs in the sample by whether or not their Canton of residence is Protestant or Catholic. There is no difference, however, in their beliefs about luck. Luck ranks last among success factors regardless of religious beliefs. Interestingly, the rankings are very similar also with respect to the other success factors, including, in particular, hard work.

Conceivably, the more confident and less risk averse entrepreneurs might underestimate the importance of luck. We therefore test if the ranking remains the same if we group entrepreneurs by degree of risk aversion and overconfidence. Yet luck clearly remains the least important success factor regardless of subsample. The ranking of the remaining factors is unaffected, too (not shown).

We also inquired into whether experience changes the opinion of entrepreneurs. If there is a self-attribution bias, seasoned entrepreneurs should rank the importance of luck less highly than rookie entrepreneurs. Yet that is not the case. Although rookie entrepreneurs assign luck a significantly higher average rank, they still rank it as the least important success factor, just as



experienced entrepreneurs do (not shown). The same goes for age. Younger entrepreneurs assign significantly more importance to luck, yet they also rank it last (not shown). Luck is the least important factor of success also when we distinguish entrepreneurs who just started their firm in the year before the survey from entrepreneurs who started it a few years before. Conceivably, entrepreneurs might have forgotten some relevant facts. The rankings of success factors in the two groups, however, are almost identical (not shown). Finally, we found no differences in the relative ranking of luck across industries, either (not shown).

Overall, there is therefore evidence that luck perceptions are partly distorted by personal situations, abilities, or experience. However, these distortions do not affect luck's relative ranking among success factors. We repeated the analysis in a multivariate context using an ordered logit regression (not shown). The results support the conclusion that luck ranks last among the six factors of success considered.

#### *4.3 Perceptions of non-entrepreneurs*

It could be that entrepreneurs as a group have a warped perception of reality. After all, entrepreneurs are more overconfident and less risk averse (Table III). To investigate this question, Table VIII splits the sample into entrepreneurs and non-entrepreneurs, defined as the subgroup of public employees, employees, engineers, and teachers in the control sample. As pointed out above, this is the subgroup of control individuals that is most representative of the population from which it is drawn. Yet, as one can see, while there are differences in average rankings between the two subsamples, they both rank luck as the least important factor of success. There is also marginal evidence that non-entrepreneurs assign a more important role to education and talent, and a less important role to hard work, experience, and connections. We

repeated the investigation by extending the definition of non-entrepreneurs to managers, but the results remain the same.

< Insert Table VIII here >

The similarity in the answers could be genuine, but it could also suggest that it was secretaries who filled out the questionnaire. To test this, we hypothesized that delegation would be more likely to occur in larger firms, since there are no secretaries in small firms to begin with. However, the ranking of luck is unrelated with firm size (not shown). Moreover, and contrary to the notion that secretaries filled out the questionnaire, entrepreneurs and non-entrepreneurs differ significantly in essentially all their other answers, including those relating to personal characteristics (Table III).

Overall, entrepreneurs (and non-entrepreneurs) appear to think that luck is the least important success factor. Our results have consequently surprising implications for the contribution that luck is believed to make to performance. If the six factors were uncorrelated, and if they were equally important, then each one would be responsible for at most 1/6th (17 percent) of firm performance. Actually, since luck is the least important success factor, it would explain even less than that. This is much less than the fraction of 62 percent estimated in Table V on the basis of our performance model. The assumption, however, is that the factors in question are uncorrelated. In what follows, we take a closer look at that assumption.

#### *4.4 Principal component analysis*

To test the assumption that the six success factors are uncorrelated, Panel C of Table VI computes Kendall rank correlation coefficients between all the different pairs of factor rankings. Because of the large number of observations, most coefficients are significantly different from

zero with confidence 0.95 or better, even if they are all numerically fairly small. To understand these relations better, we therefore turn to a principal component analysis, similar to the procedure of Kaplan, Klebanov, and Sorensen (2012). If the factors were really uncorrelated, it should not be possible to reduce them to a smaller number of principal components. The limitation of this analysis is that we have to use actual scores as opposed to ranks.

The results show that most of the variation in the six factors (66 percent) is explained by only 3 components (not shown). For an actual test of the proposition, Table IX performs a varimax rotation of those three components. The rotation maximizes the variance of the squared loadings and tends to generate components with loadings of unity and zero. The first component loads on *hard work, experience, talent, and education*. The second component has a loading of 0.92 on *connections*, and minor loadings on the remaining variables. The third component has a loading of 0.93 on *luck*, and negligible loadings on the rest. Hence, luck is one of only three uncorrelated components, which means that it could be responsible for up to 33 percent of performance variation. This is almost twice the hypothesized 17 percent under the assumption of uncorrelated performance factors. Still, 33 percent is much less than the 62 percent implied by the performance model.

< Insert Table IX here >

One possible reason for this limited role of luck could be that, as pointed out in Bhidé (2000), entrepreneurs don't typically pursue radically new ideas but mostly follow comparatively safe strategies and replicate or modify ideas seen in previous employment.

## **5 Luck in individual entrepreneurial activities**

A comparatively small role in performance does not necessarily imply a small role in all the different activities that enable firms to bring their products and services to market. To find out, and as a further test of self-attribution bias, the questionnaire asked respondents to indicate the importance of luck in eight different management areas, namely the identification of the right business idea, the decision of when to enter the market, the hiring of employees, the gaining of customers, the securing of suppliers, the obtaining of financial support, the establishing of business connections, and the setting up of private connections. For each of these activities, people were asked to score the importance of luck from very important (5) to quite unimportant (1). We investigate how entrepreneurs rate the importance of luck in these activities and whether that is consistent with the comparatively modest assessment of luck in overall performance.

To avoid interpersonal comparisons, we relied again on the scores given by respondents to infer how entrepreneurs rank the eight business activities by importance of luck. For each respondent, the area that ranked highest received a 1, and the area that ranked lowest received, in the limit, an 8. Table X reports summary statistics.

< Insert Table X here >

Based on the results, gaining customers, finding the business idea, and establishing business connections are activities in which luck is believed to play a very important role, as evidenced by the median rank of 1 implicitly assigned to these factors. With a median rank of 2, deciding when to enter the market and establishing private connections are areas where luck is slightly less important. Moreover, finding employees has a median rank of 3, and obtaining suppliers and financing are activities deemed the least subject to the vagaries of chance (median rank of

4).<sup>3</sup> Hence, there are aspects of entrepreneurial activities in which luck could potentially matter in a significant way.

To find out more, we focus on the instances in which entrepreneurs give the importance of luck the maximum possible score of 5 and investigate how often that happens. We find that close to 60 percent of the responding entrepreneurs assign a 5 in at least one of the eight management tasks considered; 40 percent do it for at least two tasks, 25 percent for at least three, and 16 percent for at least four (Table XI). By comparison, only about 15 percent assign luck the highest score in overall firm performance (Panel B of Table VI). Thus, and contrary to pervasive self-attribution, the majority of entrepreneurs view luck as being very important in at least one management area. The question then is why there is this difference in importance in individual management areas versus in overall performance.

< Insert Table XI here >

We hypothesize that entrepreneurs assess the relevance of luck in performance by taking an average of its relevance across different management tasks. Different weights in that average could reflect the different relevance of individual management tasks for overall performance. To test this hypothesis, we run a probit regression. The dependent variable, *importance of luck (bin)*, equals 1 if the entrepreneur assigns luck an important overall role, i.e., a score of 5 or 4, and it equals 0 otherwise. The arguments are binary variables equal to 1 if the entrepreneur believes luck ranks highest in a particular management area, and zero otherwise. The results are in Table XII. With the exception of financing, all the arguments have a significant coefficient.

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<sup>3</sup> There is no evidence that respondents provide undifferentiated assessments and assign similar scores across management tasks. To see this, we used the scores and conducted a principal component analysis (not shown). Luck in each individual management activity loads only on one of seven factors (with a coefficient of 1). Hence, luck plays a separate role in each individual management activity. The exception is private and business connections. Luck perceptions in those activities are driven by the same factor.

Moreover, all coefficients are smaller than 1, and their sum (if we include the intercept, which reflects the average impact of omitted variables) equals 1.34, consistent with the claim that the importance of luck in overall performance is a weighted average of the scores in the individual management tasks. Furthermore, activities that entrepreneurs believe to be more exposed to luck tend to be also activities with larger coefficients (weights), and the reverse. Specifically, finding the business idea, gaining customers, establishing business connections, and deciding when to enter the market have both a higher ranking and a larger weight. In contrast, establishing private connections and finding employees have both lower rankings and lower weights. Obtaining financing and securing suppliers have the lowest rankings and the lowest weights. The coefficient associated with suppliers is even negative. The possible interpretation is that being lucky enough to lock up the right suppliers reduces the firm's overall exposure to chance because of the advice and support these suppliers provide.

< Insert Table XII here >

## **6 Perceived luck and the entrepreneurial decision**

The crucial question is whether beliefs about the importance of luck have practical relevance and therefore affect decisions. The people in the survey do not seem to attribute a significant importance to luck, compared to other factors of success. Still, assuming entrepreneurs are risk averse, they will tend to avoid situations that, at least in their minds, expose them to chance. We examine whether that is the case in the entrepreneurial career decision itself. We model that decision with the selection equation (2) estimated above. However, we expand the set of regression arguments with the scores assigned by respondents to the various success factors. The results are the same when we measure the importance of the various success factors (including

that of luck) with binary variables (important vs. unimportant). Using scores provides more variation in the measurement of these individual factors. The estimated model is as follows:

$$Entrepreneur_i = f(\text{perceived importance of luck, perceived importance of other success factors, personal characteristics, identification variables})_i + v_i. \quad (3)$$

We test whether the prospect of being exposed to chance discourages an entrepreneurial career. The more strongly a risk-averse individual believes that success is driven by random chance, the more reluctant he should be to opt for an entrepreneurial career, as suggested by the experimental evidence in Camerer and Lovallo (1999). Perceptions about the importance of the remaining five success factors probably affect the entrepreneurial decision as well. They should all matter, since, as we saw, they are believed to determine entrepreneurial success. However, we cannot sign that influence a priori. Believing, for example, that education is important might encourage educated individuals into joining the entrepreneurial ranks, but it will deter uneducated people.

Strictly taken, since we use cross-sectional data, equation (3) does not model the decision to become an entrepreneur but rather the probability of being one. Yet being an entrepreneur is the result of both a career decision and of the probability of survival (Evans and Leighton (1989)). The results remain the same, when we focus on the subset of entrepreneurs who started their company during the last year in the sample. For them, given that they have been operating for at most one year, becoming an entrepreneur should be the same as being one.

The results are in Table XIII. There are two columns to each regression specification, the first one with the estimated regression coefficients and the second with the marginal impact of each variable. The specification in column (1) includes the six success factors with their subjective scores. The evidence shows that the importance of luck is negatively related with the

probability of becoming an entrepreneur. Believing that performance is a matter of luck therefore discourages people from going for an entrepreneurial career. Assigning luck a larger importance by one unit in a scale from 1 to 5 reduces the probability of an entrepreneurial career by roughly two percentage points. At first glance, the impact is therefore limited. For an alternative and more intuitive perspective, we computed the difference in implied probabilities between the belief that luck is very important (score of 5) and the belief that it is quite unimportant (score of 1). Individuals who believe luck is very important have a probability of becoming entrepreneurs that is 7 percentage points lower. The effect is tangible, in spite of all the likely measurement errors and the associated attenuation bias in our regression. We come back to the economic impact of luck further down.

< Insert Table XIII here >

The evidence also shows that perceptions about the other success factors matter as well. Individuals who believe *hard work* and *connections* are important are more likely to pursue an entrepreneurial career, possibly because they are willing to put in the necessary hard work and have the necessary connections. In contrast, individuals who believe education is important are deterred from following the entrepreneurial career path. As we mentioned, this result could be driven by people who feel they lack the appropriate education. Note that the marginal effects of these variables are larger than the effect associated with luck. We also find, however, that the perceived importance of *experience* and *talent* is unrelated with the entrepreneurial decision.

In column (2) of the table, we replace perceptions (other than *importance of luck*) with proxies for the individual success factors themselves. We use the following proxies for:

- a) Hard work: *number of children* and *part-time entrepreneur*. These two proxies should be inversely related with hard work;
- b) Experience: *work*, *industry*, and *management experience*;



- c) Talent: *previously unemployed and previously successful entrepreneur*;
- d) Education: *education and balanced management education*;
- e) Connections: *connections*.

We want to know whether perceptions about success factors are supported by fact. Under this specification, *importance of luck* maintains its negative and significant coefficient. As for the other success factors, they have mostly significant coefficients. The willingness to put in hard work, management experience, education (whether general or management-related), and connections (Honig and Davidsson (2000), Davidsson and Honig (2003)) provide a significant encouragement for an entrepreneurial career. In the group of proxies for experience, however, *work experience* per se provides only a weak enticement to become an entrepreneur. What matters is the *management* know-how gained over the years. *Industry experience* has even a negative coefficient, possibly because industry-specific experience is associated with better remuneration, which raises the opportunity costs of entrepreneurship. Furthermore, there is only weak evidence at best that talented individuals choose an entrepreneurial career. *Previously successful entrepreneurs* are marginally more likely to get involved in another start-up. But *previously unsuccessful entrepreneurs*, and, therefore, probably less talented entrepreneurs, tend to try again as well—the possible stigma associated with failure discussed in Landier (2006) does not discourage them. Failed entrepreneurs seem to believe they have their chances, consistent with a deep market for failed entrepreneurs (Gromb and Scharfstein (2005)). Along similar lines, *previously unemployed*, and therefore presumably less talented individuals are also more likely to embark on an entrepreneurial career, a regularity already noted by Evans and Leighton (1989).

Column (3) repeats the estimation with the addition of the interaction variable *importance of luck\*high balanced management education*. High balanced management education is a binary

variable equal to 1 if the individual's management education is in the top quartile of the sample distribution, and equal to zero otherwise. We test whether the relevance of luck provides different motivations, depending on people's know-how. Individuals with good know-how are discouraged from becoming entrepreneurs if they believe performance is mostly a matter of luck (Camerer and Lovallo (1999)).

The evidence is inconsistent with this hypothesis. The coefficient of the interaction term is positive and statistically significant. Individuals who assign luck an important role seem to be more willing to become entrepreneurs if they have the appropriate education. Note that the negative coefficient of *importance of luck* alone remains essentially unchanged and maintains its statistical significance. The coefficient of *balanced management education* also remains positive and significant, although it falls numerically by one half. The remaining coefficients remain essentially unchanged.

We then repeated the investigation and focused on individuals with poor education. One could argue that these individuals might be attracted to an entrepreneurial career if they also believe in the importance of luck, since they might see better chances to succeed against their more knowledgeable counterparts (Karelaia and Hogarth (2010)). To find out, we measured low *balanced management education* with a binary variable equal to 1 if the individual's education is in the lowest quartile of the sample distribution, and equal to zero otherwise. We then replaced high with low balanced management education in the interaction term. The evidence in column (4) of the table, however, contradicts our conjecture. The interaction term has a negative and statistically significant coefficient. Individuals with little management education tend to stay away from an entrepreneurial career if they also believe luck to be important. One possible reason is that they might be afraid that insufficient know-how could make it difficult to deal with

adverse developments. In this specification, the coefficient of the importance of luck alone loses its statistical significance.

The regressions in the table include a number of control variables that describe personal characteristics. Several of their coefficient estimates have the same sign and significance observed elsewhere in the literature with non-survey data. For example, the coefficient of *internal locus of control* is positive and highly significant. Hence, individuals who believe they control their life are more likely to opt for an entrepreneurial career. Moreover, *risk aversion* has a negative effect (Brockhaus (1980), Stewart Jr. and Roth (2001)) and *overconfidence* a positive one, consistent with Holtz-Eakin, Joulfaian, and Rosen (1994b), Busenitz and Barney (1997), and Camerer and Lovallo (1999), but not with Hogarth and Karelaia (2011). Divorced individuals have a higher propensity for trying an entrepreneurial career, which they might see as an opportunity for change. The opposite seems to be the case for married people, possibly because the risk of failure is too costly to take. We also find that women are significantly less likely to join the entrepreneurial ranks, whereas foreigners are more likely to do so. Interestingly, personal age has a nonlinear impact, in line with Van Gelderen, Thurik, and Bosma (2006). The probability of becoming an entrepreneur increases until age 33, and then it declines. Perhaps not surprisingly, people living in Protestant regions are also significantly more likely to try an entrepreneurial career than people living in Catholic regions are, possibly because they believe in the virtues of hard work. Finally, we find significant cultural differences. Compared to individuals in German-speaking Cantons, people in the French- and Italian-speaking Cantons are significantly less willing to become entrepreneurs.

The regressions also include five identification variables used later in our Heckman two-stage analysis of firm performance. All of them have positive and significant coefficients.

Higher net wealth, being prone to making career choices by chance, stronger motivation achievement, having been employed in a small firm, and having entrepreneurial parents all favor an entrepreneurial career.

In conclusion, the results in Table XIII indicate that the entrepreneurial decision is shaped by beliefs, particularly about the role that luck plays in bringing about success. Perceptions about the importance of other success factors, and the actual value of those factors also matter. Consistent with our arguments, individuals who believe luck is important tend to be more reluctant to embark on an entrepreneurial career. Economically, this effect is tangible and amounts, in the limit, to a reduction by 7 percentage points in the probability of choosing such a career. To put this effect in perspective, it helps to compare it to other discouraging effects we measure in Column (2) of the table. For example, it corresponds to one half the effect of being a woman and to almost three times the effect of having children. Given that the relevance of luck is probably measured with substantial error, the actual coefficient could be numerically larger than what we estimate here.

## **7 Perceived luck and decision making by entrepreneurs**

This section investigates whether luck perceptions influence the decision-making and behavior of entrepreneurs. The available data enable the analysis of: (a) the propensity to tap a fraction of the assets in the entrepreneurs' defined contribution pension plan to fund their firms; (b) the willingness to work full-time; and (c) the perception of luck also as upside potential.<sup>4</sup>

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<sup>4</sup> We do not have data for a meaningful investigation of the financial leverage decision in our start-ups. For the U.S., see Cole (2013).

### 7.1 *Luck perceptions and financing decisions*

We want to know whether the perceived importance of luck shapes financing choices. Table XIV studies the decision to use a fraction of the assets in the entrepreneur's defined contribution pension plan to fund the firm. By law, drawing down assets in one's defined contribution plan is possible only to start proprietorships, not when starting LLCs or corporations. We expect that proprietors who think they are exposed to the whims of fortune should be hesitant to tap their pension fund's assets. To test the hypothesis, we perform a probit regression with the standard specification. The dependent variable equals 1 if the entrepreneur uses any of his pension fund money to finance the firm, and it equals 0 otherwise. The control variables are the same as those in regression model (2), except for the inclusion of the identification variables. Because of space constraints, we report only a subset of the coefficient estimates.

< Insert Table XIV here >

As one can see, *Importance of luck* has the predicted negative and significant coefficient. Interestingly, interacting *Importance of luck* with *initial capital* (measured with a binary variable equal to 1 if the starting capital is above the median value for firms of the same legal form, and equal to 0 otherwise), yields a positive and significant coefficient. One possible explanation is that being able to raise a substantial amount of starting capital is a favorable signal for the entrepreneur who assigns chance an important role, and hence an incentive to invest more of his own money. Not surprisingly, overconfidence has a positive and significant coefficient, whereas risk aversion a negative one. When distinguishing firms by legal form, we observe that, consistent with the law, *Importance of luck* has a significant coefficient in the group of firms registered as proprietorships. In contrast, in the case of corporations, the coefficient is only

marginally significant. These could be corporations in our sample that started out as proprietorships.

### *7.2 Importance of luck and part-time entrepreneurship*

In Panel B of the table, we use the same regression specification to investigate the decision to work part-time. One complicating factor in this decision is that, in the case of corporations and LLCs, there is also a minimal initial capital commitment. Hence, there is self-selection, in the sense that firms that have these legal forms tend to be more promising start-ups, and consequently companies that it pays the entrepreneur to spend time on. We therefore distinguish between proprietorships and corporations. Twenty-seven percent of the entrepreneurs in proprietorships work only part-time. If that decision reflects concerns about the exposure to random events as an entrepreneur, the coefficient of *Importance of luck* should be positive and significant. The results indicate that individuals who assign a larger role to luck tend indeed to be significantly more often part-timers in proprietorships. The coefficient is, however, statistically zero when we repeat the investigation for corporations (the fraction of part-timers there is 30 percent).

### *7.3 Chance and upside potential*

Since entrepreneurs are often thought of as the source of innovation and growth, we want to test whether they are aware of the real-option possibilities that random events imply. Entrepreneurs were asked whether they agreed with the statement that “*As entrepreneurs, we do not want to eliminate chance, but we want to be well prepared for it.*” This could be the intention of being ready to limit the consequences of bad luck, but also the intention of being able to seize the

opportunities of good luck when it materializes. We therefore investigate the answers to the above question with the same regression specification employed in the previous panels. The variable *Being prepared for luck* equals 1 if the entrepreneur answered: I fully agree or I almost fully agree; otherwise, it equals 0. If the desire of being prepared is dictated by a concern about the downside implications of luck, then both the coefficient of the variable *Risk aversion*, a measure of risk preferences, and that of *Importance of luck*, a measure of perceived risk exposure, should be positive. In contrast, if the desire reveals the appreciation for the upside implications of luck, the coefficient of *Importance of luck* should be positive, whereas that of *Risk aversion* should be nonpositive (risk aversion might temper the enthusiasm for the upside potential of luck).

Regression estimates are in Panel C of the table. Because of space constraints, we report only a subset of the coefficient estimates. In the full sample, the coefficient of *Importance of luck* is positive and significantly different from zero at conventional significance levels, whereas *Risk aversion* has a coefficient that is negative but not significant. Hence, being prepared for unexpected events seems to be more the expression of an appreciation of the upside potential of random events than of a concern about the downside threat. We find no difference in this result when we distinguish between proprietorships and corporations.

## **8 Perceived luck and unexplained performance**

The survey question referred to luck as unexpected events. The last section of the paper provides a validation test of what respondents told us. We therefore investigate whether what appears to be unexpected to entrepreneurs correlates with the unexplained component in our standard model

of entrepreneurial performance (1). Specifically, we repeat the Heckman two-stage estimation procedure of equation (1), using the model of entrepreneurial career choice reported in column (2) of Table XIII as the first stage. We test whether entrepreneurial luck perceptions correlate with the error term in equation (1). To do so, we first need a subjective measure of unexpected performance. The variable *importance of luck* does not do because it relates to a generic question about performance factors not necessarily related to the entrepreneur's current firm. Since we want to compare model implied and subjective measures of luck, we need a subjective assessment of the importance of luck in the specific case of the entrepreneur's current firm. We therefore rely on the subjective assessment of success with the current firm. We construct two luck measures, namely *good luck* (a binary variable equal to 1 if the entrepreneur says current business has performed better than expected, and equal to 0 otherwise) and *bad luck* (a binary variable equal to 1 if the entrepreneur says current business has performed worse than expected, and equal to 0 otherwise). If perceived luck is related to unexplained performance, these two proxies should have power to explain the error term in equation (1). Furthermore, whereas *good luck* should have a positive coefficient, *bad luck* should have a negative one.

### 8.1 Estimation results

Table XV reports the results. *Good luck* and *bad luck* both have statistically highly significant coefficients. Moreover, whereas *good luck* has a positive coefficient, *bad luck* has a negative one. The absolute value of the coefficients is practically identical: the coefficient of *good luck* is 0.568, and that of *bad luck* is -0.573.

< Insert Table XV here >



The implication of all this is that what entrepreneurs have in mind when they think of chance is indeed correlated with unexplained performance variation. Hence, perceived luck correlates with unexpected performance shocks.

The remaining coefficient estimates in Table XV are mostly consistent with those reported in the extant literature with secondary data, a finding which lends support to the validity of the survey data. In particular, a number of the success factors investigated in the survey are indeed related with performance:

- a) *Management experience* has a positive and significant coefficient, consistent with Kaplan, Sensoy, and Strömberg (2009). So does, at least marginally, *industry experience*, as in Chatterji (2009). *Work experience* per se, however, does not seem to be an important premise for superior entrepreneurial performance;
- b) Similarly, *part-time entrepreneur* has a significantly negative relation with sales, in agreement with the notion that insufficient dedication is detrimental to performance. This result is compatible with the evidence in Bitler, Moskowitz, and Vissing-Jørgensen (2005). *Number of children*, another proxy for hard work, however, has an insignificant coefficient;
- c) Both proxies for talent (*previously unemployed* and *previously successful entrepreneur*) have insignificant coefficients. However, when we winsorize our performance measure at the 5th and 95th percentiles, the coefficient of *previously unemployed* becomes negative and significant. Formerly unemployed people might therefore be less talented entrepreneurs, consistent with Evans and Leighton (1989). The finding that *previously successful entrepreneur* is unrelated with performance seems to contradict Gompers, Kovner, Lerner, and Scharfstein (2010) who find performance persistence among previously successful entrepreneurs. Previous success could be a proxy for variables included here but not in their study, such as management experience and management education.
- d) Of the two proxies for education, only *balanced management education* has a (marginally) significant impact on performance. *Education* per se has no impact;
- e) The last success factor, *connections*, has an insignificant coefficient.

A look back at the ranking of success factors by entrepreneurs shows that these results are roughly in line with those rankings. The factors that rank highest in the opinion of entrepreneurs, namely hard work, talent, and experience do in fact have a positive influence on performance. Of the factors that rank lower, namely education and connections, only education has a marginal influence, and only in the form of balanced management education.

With regard to personal characteristics, *internal locus of control*, *risk aversion*, and *overconfidence* have insignificant coefficients (the latter finding is consistent with Hirshleifer, Low, and Teoh (2010)). *Married* has a positive coefficient. Married entrepreneurs might feel a stronger pressure to succeed to support their family. *Female* is highly negatively correlated with performance. Since this coefficient is conditional on firm size, it cannot be explained with the tighter capital constraints that female entrepreneurs seem to face (Parker (2004)). *Age* has a concave relation with sales. *Protestant* does not correlate with performance. Neither do *Divorced* and *Foreigner*. Interestingly, entrepreneurs in *French Cantons* tend to do better than those in German Cantons.

As concerns the firm-specific controls, firm size (measured either in terms of initial capital or number of employees) has a positive relation with performance, possibly because the size of a start-up is a proxy for success. *Equity ownership* has a negative and significant relation with sales.<sup>5</sup> *Sole proprietorship* also has a negative coefficient, possibly because sole proprietorships tend to be substantially smaller organizations. *VC backing* is positively related with performance, perhaps a reflection of the ability of venture capitalists to pick comparatively better firms. This result should be taken with a grain of salt, however, since few firms enjoy VC support to begin with.

Overall, the estimation of the effect of the various control variables shows that what entrepreneurs indicate as being success factors are generally tied to performance. That holds

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<sup>5</sup> The negative association between ownership and sales is consistent with the OLS findings in Bitler, Moskowitz, and Vissing-Jørgensen (2005). Ownership, however, might be endogenous. We therefore estimate a two-stage least squares regression with the same instruments as Bitler, Moskowitz, and Vissing-Jørgensen (2005). The instruments are binary variables that identify whether the entrepreneur is the founder and whether he has inherited the firm, in addition to age, and age squared. Under that specification, ownership has a positive impact on performance (not shown).

also for luck. Furthermore, the results are consistent with those reported in the literature on the basis of secondary data, which seems to bear out the validity of our survey.

## **9 Conclusions**

According to the entrepreneurs in the survey, luck is the least important of six success factors considered, even among people less prone to self-attribution bias. One might therefore wonder whether perceptions correspond to reality. Kahneman (2011) argues that people are inclined to underestimate the role of chance in events. Assuming causality and being on the lookout for systematic patterns in the environment might have helped our ancestors to watch out for predators and survive. Our findings that luck has comparatively little importance could therefore reflect a primordial underestimation. The problem with this explanation is that, whereas entrepreneurs attribute less than one third of performance variation to chance, they also believe that luck is very important in individual aspects of entrepreneurship. An alternative explanation of our results is that entrepreneurs do not generally pursue radically new ideas (Bhidé (2000)).

Still, believing that luck counts for less than one third of overall performance seems indeed to be low when compared with the fact that every other firm in a given cohort of start-ups disappears within five years. As it turns out, however, this conundrum is more apparent than real. Not all exits are unexpected. A sizable fraction of firms that disappear does so predictably—either because they are predictably poorly managed and are consequently liquidated or because they are predictably well managed and are therefore taken over or merged. Hence, unpredicted exits are probably significantly lower than 50 percent over five years.

The results have implications for many players in the market for start-ups. For academics, they show that entrepreneurs are aware of randomness (overall and in different management

areas) and that they make decisions based on those beliefs. For entrepreneurs, the message is: get an education, work hard, rely on your experience, and don't let randomness discourage you, it is not the decisive factor. For suppliers and providers of capital, the results suggest that entrepreneurs are fairly rational, in that they can tell the difference between chance and systematic events. For regulators, the evidence indicates that the appropriate measures to support entrepreneurship are management education programs and programs to provide inexperienced entrepreneurs with the support of navigated business people. Ultimately, however, the evidence shows support for some of the principles on which Western societies are generally founded: hard work, experience, and education seem to enhance performance. Success is not mainly the luck of the draw.

## Appendix: Variable definitions

Variable	Description
<i>Panel A: Measures of luck</i>	
<i>Career by chance</i>	Binary variable equal to 1 if the individual claims his/her career occurred by chance, and equal to 0 otherwise;
<i>Good luck</i>	Binary variable equal to 1 if the entrepreneur claims his/her current business performed better than expected, and equal to 0 otherwise;
<i>Bad luck</i>	Binary variable equal to 1 if the entrepreneur claims his/her current business performed worse than expected, and equal to 0 otherwise. There are entrepreneurs claiming that business turned out as expected;
<i>Importance of luck</i>	The score given to luck by survey participants. The possible score ranges from very important (5) to quite unimportant (1).
<i>Importance of luck (bin)</i>	A binary variable equal to 1 if respondents give <i>importance of luck</i> a score of 5 or 4, and equal to 0 if they give a score of 3, 2 or 1.
<i>Panel B: Measures of skills</i>	
<i>Education</i>	Years of education, as in Parker (2004);
<i>Balanced management education</i>	Number of different functional areas in management the entrepreneur is educated in, as in Lazear (2004). This variable ranges between 0 and 5, with 5 meaning that the individual was educated in marketing, finance and accounting, strategy, human resources management, and organization;
<i>Age</i>	Number of years since birth;
<i>Work experience</i>	Years of work experience, as in Parker (2004);
<i>Industry experience</i>	Years of work experience in the firm's industry, as in Evans and Leighton (1989);
<i>Management experience</i>	Years of management experience, as in Kim, Aldrich, and Keister (2006);
<i>Connections</i>	Binary variable equal to 1 if the entrepreneur is a member of a business network, and equal to 0 otherwise.
<i>Panel C: Measures of personal characteristics</i>	
<i>Risk aversion</i>	One minus the percentage of additional hypothetical wealth the respondent would invest in risky assets. Risky assets are stocks, mutual fund shares, warrants, puts, calls, structured products, hedge or private equity fund shares, real estate, commodity futures, commodity funds, and equity invested in own firm, as in Cohn, Lewellen, Lease, and Schlarbaum (1975);
<i>Overconfidence</i>	Percentage of additional hypothetical wealth the respondent would invest in his/her own company, respectively in the company he works for. This measure is in the spirit of Malmendier and Tate (2005). One of their measures of overconfidence is to look at CEOs who hold options in their firms beyond rational thresholds;
<i>Need for achievement</i>	Binary variable equal to 1 if the individual has a high need for achievement. Persons with this preference set challenging goals and work hard to achieve them. This variable is defined as in Lynn (1969);

Variable	Description
<i>Internal locus of control</i>	Binary variable equal to 1 if the individual has an internal locus of control. Individuals with an internal locus of control believe their life mainly depends on their personal decisions and hard work (Rotter (1966));
<i>Previously employed in a small firm</i>	Binary variable equal to 1 if individual previously worked in a small firm, and equal to 0 otherwise;
<i>Part-time entrepreneur</i>	Binary variable equal to 1 if the entrepreneur has another job, and equal to 0 otherwise;

*Panel D: Firm-specific control variables and other variables*

<i>Ownership</i>	Entrepreneurial ownership in percent, as in Bitler, Moskowitz, and Vissing-Jørgensen (2005);
<i>Net wealth</i>	Gross assets of the individual (including real estate holdings, financial assets, and value of equity participation in unlisted firms) minus total debt in Swiss Francs;
<i>Sole proprietorship</i>	Binary variable equal to 1 if firm is a sole proprietorship, and equal to 0 otherwise;
<i>Initial capital</i>	Capital raised at the start of the company, adjusted for the formation year of the company by compounding at the risk free rate;
<i>Current equity</i>	Firm equity;
<i>Employment</i>	Current number of employees;
<i>Leverage</i>	Current debt/equity ratio;
<i>Venture capital backed</i>	Binary variable equal to 1 if firm is venture capital or business angel backed;
<i>Protestant</i>	Binary variable equal to 1 if the entrepreneur lives in a Canton where the majority of the population is Protestant;

*Panel E: Measures of firm performance*

<i>Industry-adjusted log(sales)</i>	Natural logarithm of firm sales, minus the corresponding median value in the subsample of firms in the same industry that were started in the same year. The variable is winsorized at the 1st and 99th percentiles of its distribution.
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**Table I**  
**Representativeness of Entrepreneur Sample**

Legal form	Founding year	Number population firms	(3) as fraction of total population	Number questionnaires sent	Percentage sent out of population	Number of questionnaires received	(7) as fraction of total received	Difference (8) – (4)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Corporations	2002	5,629	0.074	2,977	52.89%	213	0.068	-0.006
Corporations	2004	6,724	0.089	3,555	52.87%	185	0.059	-0.030
Corporations	2006	7,736	0.102	4,090	52.87%	336	0.108	0.005
LLCs	2002	7,234	0.096	3,825	52.88%	289	0.093	-0.003
LLCs	2004	9,567	0.126	5,058	52.87%	399	0.128	0.001
LLCs	2006	11,128	0.147	5,884	52.88%	533	0.171	0.024
Proprietorships	2002	7,237	0.096	3,827	52.88%	300	0.096	0.000
Proprietorships	2004	9,428	0.125	4,985	52.87%	407	0.130	0.006
Proprietorships	2006	10,968	0.145	5,799	52.87%	461	0.148	0.003
Total		75,651		40,000	52.87%	3,123		

**Table II**  
**Summary Statistics for Entrepreneurs**

Entrepreneurs are individuals who work at least part-time in a company in which they hold a financial stake. Variable definitions are in the Appendix.

Variable	Mean	Min	Lower quartile	Median	Upper quartile	Max	Standard Deviation	N
<i>Panel A: Firm-specific variables</i>								
Sole proprietorship	44%	–	–	–	–	–	–	3,082
LLCs	31%	–	–	–	–	–	–	3,082
Corporations	24%	–	–	–	–	–	–	3,082
Initial number of employees (including the entrepreneur)	3	0	1	1	2	330	8.66	2,956
Current number of employees (including the entrepreneur)	5.62	0	1	1.75	4	1,190	36.76	2,979
Equity in thousands CHF	856	0	41	118	312	200,000	7,970	1,332
Ownership (percentage)	85.31	1.00	80.00	100.00	100.00	100.00	25.91	3,104
Venture-capital- backed (proportion)	0.02	0.00	0.00	0.00	0.00	1.00	–	3,000
Protestant region (proportion)	0.53	0.00	0.00	1.00	1.00	1.00	–	2,956
<i>Panel B: Personal characteristics</i>								
Part-time entrepreneur	0.29	0.00	0.00	0.00	1.00	1.00	0.46	3,051
Previously successful	0.23	0.00	0.00	0.00	0.00	1.00	0.42	3,051
Previously unsuccessful	0.08	0.00	0.00	0.00	0.00	1.00	0.27	3,051
Former employer: up to 49 employees	0.52	0.00	0.00	1.00	1.00	1.00	0.50	3,098
German culture	71%	–	–	–	–	–	–	3,099
French culture	24%	–	–	–	–	–	–	3,099
Italian culture	5%	–	–	–	–	–	–	3,099
<i>Panel C: Firm performance</i>								
Firm sales in thousands CHF	2,010	0	70	200	600	2,500,000	48,800	2,697

**Table III**  
**Sample Averages: Comparison of Entrepreneurs and Non-Entrepreneurs**

Means (frequencies for binary variables), standard deviations, and differences in means between entrepreneurs and non-entrepreneurs, as well as z-values (based on a Mann-Whitney test). Entrepreneurs are defined as individuals who work at least part-time in a company in which they hold a financial stake. The sample consists of 2,485 entrepreneurs and 3,467 employees. Variable definitions are provided in the Appendix. Asterisks denote statistical significance at the 1% (\*\*\*), 5% (\*\*), or 10% (\*) level (two-sided tests).

	All	Entrepreneurs	Non-entrepreneurs	Difference
<i>Entrepreneurial characteristics</i>				
Work experience	28.27	24.42	30.59	-6.17***
Management experience	12.35	11.93	12.62	-0.70***
Industry experience	19.49	14.99	22.30	-7.30***
Previously unemployed	0.03	0.04	0.02	0.02***
Education	14.12	14.47	13.92	0.55***
Balanced management education	0.82	1.09	0.65	0.44***
Connections	0.10	0.16	0.07	0.09***
<i>Personal characteristics</i>				
Age	50.50	45.10	53.74	-8.64***
Risk-aversion	0.38	0.30	0.43	-0.13***
Overconfidence	0.13	0.21	0.08	0.14***
Internal locus of control	0.22	0.24	0.21	0.03***
Female	0.23	0.18	0.26	-0.08***
Married	0.68	0.64	0.70	-0.06***
Divorced	0.09	0.09	0.08	0.01
Number of children	1.56	1.36	1.68	-0.32***
Foreigner	0.12	0.16	0.09	0.08***
<i>Identification variables</i>				
Net wealth	12.56	12.63	12.52	0.11**
Career by chance	0.67	0.73	0.63	0.10***
Need for achievement	0.37	0.43	0.33	0.10***
Entrepreneurial parents	0.27	0.32	0.23	0.09***

**Table IV**  
**Sample comparison with the extant literature**

The table compares characteristics of our sample of entrepreneurs with those of the sample in Bitler, Moskowitz, and Vissing-Jørgensen (2005). That sample draws on two sources. The first source is the 1989, 1992, 1995, 1998, and 2001 *Survey of Consumer Finances* (SCF), sponsored by the Federal Reserve Board, which provides information, among other things, on investment in private firms. The second source comes from two surveys of small businesses, also sponsored by the Federal Reserve Board: the 1993 *National Survey of Small Business Finances* (NSSBF) and the 1998 *Survey of Small Business Finances* (SSBF).

Variable	Our sample		Bitler et al. (2005) <i>SCF Sample</i>		Bitler et al. (2005) <i>NSSBF and SSBF Samples</i>	
	Mean	Median	Mean	Median	Mean	Median
Male	82%	-	80.1%	-	81.4%	-
Age	45	44	46	44	49	49
Work experience	24.4	24	21	21	18	16
Ownership (percent)	85.31	100.00	85.1	100.0	83.4	100
Current number of employees (including the entrepreneur)	5.62	1.75	10.4	3	8	3
Firm sales in thousands CHF (1 USD = 1.02 CHF)	2,010	200	927	92	746	171



**Table V**  
**Performance of Entrepreneurial Firms**

Heckman's two-step procedure with nondisclosure dummies (not reported). In the selection equation, the dependent variable takes value 1 if an individual is an entrepreneur and zero otherwise. Entrepreneurs are defined as individuals who work at least part time in a company in which they hold a financial stake. In the second stage, the dependent variable is the industry-adjusted logarithm of firm sales. Variable definitions are provided in the Appendix. The sample comprises 7,495 individuals in the selection equation and 2,349 entrepreneurs (firm sales) in the performance regressions. Asterisks denote statistical significance at the 1% (\*\*\*) , 5% (\*\*), or 10% (\*) level.

	Selection equation (probit) (1)	Industry-adjusted log(firm sales) (2)
Entrepreneurial skills	Yes	Yes
Personal characteristics	Yes	Yes
Firm-specific control variables	No	Yes
Identification variables	Yes	No
Inverse Mills ratio ( $\lambda$ )	No	Yes
Number of observations	7,495	2,349
R-squared	0.30	0.378
Adjusted R-squared		0.370
McFadden's adjusted R-squared	0.27	
Correctly predicted (percentage)	77.6	

**Table VI**  
**Rankings of Success Factors in Entrepreneurial Performance**

Entrepreneurs were asked to provide scores for six factors of entrepreneurial success: luck, experience, talent, hard work, education, and connections. The possible scores range from *very important* (5) to *quite unimportant* (1). For each respondent, we used the reported scores to infer his/her rankings of the factors of success (the highest possible rank is 1 and the lowest is 5). Entrepreneurs are individuals who work at least part-time in a company in which they hold a financial stake. Variable definitions are provided in the Appendix. Panel A provides descriptive rankings statistics. Panel B shows what proportion of respondents give a particular factor the highest (or the lowest) rank. Panel C computes rank-correlation coefficients between pairs of success factor ranks.

<i>Panel A: Rankings</i>						
Ranking	Mean	St. Dev.	Min	Median	Max	Number of observations
Luck	4.50	1.86	1.00	5.00	6.00	3,018
Hard work	1.58	1.18	1.00	1.00	6.00	3,063
Experience	1.94	1.39	1.00	1.00	6.00	3,055
Talent	1.61	1.13	1.00	1.00	6.00	3,054
Education	2.48	1.67	1.00	2.00	6.00	3,049
Connections	2.62	1.78	1.00	2.00	6.00	3,044

  

<i>Panel B: Extreme Rankings</i>		
Proportion of cases who rank a factor as	Highest	Lowest
Luck	15.47%	78.43%
Hard work	74.86%	14.53%
Experience	60.43%	18.46%
Talent	70.99%	14.34%
Education	47.23%	28.30%
Connections	47.11%	28.12%
Start-ups do not need luck to succeed		57.80%
Minimum number of observations		3,018

  

<i>Panel C: Kendall Rank Correlation Matrix of Factor Ranks</i>						
	Luck	Hard work	Experience	Talent	Education	Connections
Luck	1.0					
Hard work	-0.17	1.00				
Experience	-0.09	0.12	1.00			
Talent	-0.13	0.17	0.22	1.00		
Education	-0.24	0.14	0.14	0.15	1.00	
Connections	-0.03	-0.04	-0.03	-0.05	-0.01	1.00

**Table VII**  
**Rankings of Success Factors as a Function of Different Individual Characteristics and Situations**

Entrepreneurs were asked to provide scores for six factors of entrepreneurial success: luck, experience, talent, hard work, education, and connections. The possible scores range from *very important* (5) to *quite unimportant* (1). For each respondent, we used the reported scores to infer his/her rankings of the factors of success (the highest possible rank is 1 and the lowest is 5). Entrepreneurs are individuals who work at least part-time in a company in which they hold a financial stake. Variable definitions are provided in the Appendix. Asterisks denote statistically significant differences in means at the 10%, 5%, 1% (\*, \*\*, \*\*\*) level of confidence (two-sided Wilcoxon rank sum tests), respectively.

<i>Panel A: Split by firm performance. Good performance is sales above the industry median value of firms of the same age</i>			
	Good performance	Poor performance	
Hard work	1.56	1.62	
Talent	1.60	1.60	
Experience	1.95	1.97	
Education	2.55	2.44	
Connections	2.67	2.56	
Luck	4.50	4.50	
Start-ups do not need luck to succeed	62.4%	55.3%***	
Number of observations	1,097	1,145	

  

<i>Panel B: Split by locus of control</i>			
	Internal locus of control	External locus of control	
Hard work	1.41	1.63***	
Talent	1.58	1.61**	
Experience	1.90	1.95	
Education	2.37	2.52***	
Connections	5.06	2.49***	
Luck	5.06	4.32***	
Start-ups do not need luck to succeed	69.1%	55.0%***	
Number of observations	708	2,216	

  

<i>Panel C: Split by cultural region</i>			
	German	French	Italian
Hard work	1.58	1.44*	1.34***
Talent	1.61	1.59	1.58
Experience	1.93	1.80*	2.04
Education	2.42	2.63**	2.23
Connections	2.65	2.66	2.28**
Luck	4.53	4.64	4.49
Start-ups do not need luck to succeed	59.7%	52.8%***	44.2%***
Number of observations	1,690	460	147

  

<i>Panel D: Split by religion</i>		
	Protestant	Other
Hard work	1.63	1.52**
Talent	1.62	1.60
Experience	1.95	1.96
Education	2.53	2.43
Connections	2.59	2.63
Luck	4.45	4.55
Start-ups do not need luck to succeed	58.8%	57.1%
Number of observations	1,517	1,350

**Table VIII**  
**Rankings of Success Factors: Entrepreneurs vs. Non-Entrepreneurs**

Entrepreneurs were asked to provide scores for six factors of entrepreneurial success: luck, experience, talent, hard work, education, and connections. The possible scores range from *very important* (5) to *quite unimportant* (1). For each respondent, we used the reported scores to infer his/her rankings of the factors of success (the highest possible rank is 1 and the lowest is 5). Entrepreneurs are individuals who work at least part-time in a company in which they hold a financial stake. Non-entrepreneurs are employees, public employees, engineers, and teachers. Variable definitions are provided in the Appendix. Asterisks denote statistical significance at the 1% (\*\*\*) level of confidence (two-sided tests Wilcoxon rank-sum tests).

	Entrepreneurs	Non-entrepreneurs
Hard work	1.58	1.70***
Talent	1.61	1.54
Experience	1.94	2.04***
Education	2.48	1.97***
Connections	2.62	3.31***
Luck	4.50	4.60
Start-ups do not need luck to succeed	57.8%	No observations (question not asked)
Minimum number of observations	2,987	2,430

**Table IX**  
**Principal Component Analysis of Six Success Factors; Varimax Rotation**

The table performs a principal component analysis of the six success factors with a varimax rotation of the coordinates to help the interpretation. In doing so, we reduce the number of components to three. Entrepreneurs were asked to provide scores for six factors of entrepreneurial success: luck, experience, talent, hard work, education, and connections. The possible scores range from *very important* (5) to *quite unimportant* (1). Entrepreneurs are individuals who work at least part-time in a company in which they hold a financial stake. Variable definitions are provided in the Appendix.

Variable	Component 1	Component 2	Component 3
Luck	0.021	0.040	0.927
Hard work	0.535	0.020	0.202
Experience	0.565	-0.162	0.100
Talent	0.472	-0.073	-0.178
Education	0.414	0.344	-0.238
Connections	-0.030	0.921	0.048
Eigenvalue	1.872	1.055	1.050
Cumulative proportion of variance explained	0.312	0.488	0.663

**Table X**  
**Importance of Luck in Eight Management Tasks: Summary Statistics of Rankings**

The table reports descriptive statistics for the importance of luck in eight different management activities. The original question asked: “How important is pure chance for an entrepreneur in the following areas: business idea, optimal timing for entry, finding employees, gaining customers, securing suppliers, financing, business connections, and private connections?” To avoid interpersonal comparisons, we used the scores given to the importance of luck in the eight different management areas to infer personal rankings. For each respondent, the area that ranked highest received a 1, and the area that ranked lowest received, in the limit, an 8. Entrepreneurs are individuals who work at least part-time in a company in which they hold a financial stake.

Area	Mean	Min	Lower quartile	Median	Upper quartile	Max	Standard deviation	N
Gaining customers	2.28	1	1	1	3	8	1.76	2,957
Establishing business connections	2.30	1	1	1	3	8	1.69	2,958
Conceiving of business idea	2.60	1	1	1	4	8	2.09	2,974
Establishing private connections	2.86	1	1	2	4	8	2.08	2,952
Optimal timing for entry	3.02	1	1	2	5	8	2.25	2,953
Finding employees	3.28	1	1	3	5	8	2.23	2,944
Obtaining financing	4.06	1	1	4	6	8	2.40	2,942
Securing suppliers	4.18	1	2	4	6	8	2.34	2,923

**Table XI****Frequency of Entrepreneurs Who Believe Luck is Very Important in Different Management Tasks**

The table examines how many entrepreneurs believe luck is very important in individual management activities. Entrepreneurs were asked to score the importance of luck in eight individual management activities. The original question asked: “*How important is pure chance for an entrepreneur in the following areas: business idea, optimal timing for entry, finding employees, gaining customers, securing suppliers, obtaining financing, establishing business connections, and establishing private connections?*” We focus here on the instances in which entrepreneurs gave the importance of luck the maximum score of 5. Entrepreneurs are individuals who work at least part-time for the company in which they hold a financial stake.

<b>Entrepreneurs who believe luck is important in at least:</b>	<b>Frequency</b>	<b>Percentage</b>
One management area	1,612	57.88%
Two management areas	1,114	40.00%
Three management areas	702	25.21%
Four management areas	451	16.19%
Total number of responding entrepreneurs	2,785	100.00%

**Table XII**  
**Luck as a Determinant of Entrepreneurial Success and Luck in Eight Different Management Tasks**

The table reports estimates of a probit regression. The dependent variable is a binary variable equal to 1 if the entrepreneur believes luck is an important determinant of overall firm performance (score of 5 or 4), and equal to 0 otherwise. The regression arguments are binary variables equal to 1 if the entrepreneur believes luck is very important in the management area in question, and equal to 0 otherwise. Entrepreneurs work at least part-time for the company in which they hold a financial stake. Variable definitions are provided in the Appendix. Asterisks denote statistical significance at the 1% (\*\*\*) , 5% (\*\*), or 10% (\*) level (two-sided tests).

Area	Coefficient estimate	$\partial f/\partial x$	z-value
Conceiving of business idea	0.259***	0.100***	4.710
Optimal timing for entry	0.289***	0.112***	5.427
Finding employees	0.180***	0.070***	3.188
Gaining customers	0.195***	0.076***	3.276
Securing suppliers	-0.131**	-0.050**	-2.051
Obtaining financing	0.045	0.017	0.747
Establishing business connections	0.323***	0.124***	5.029
Establishing private connections	0.175***	0.068***	2.935
Constant	-0.982***		-17.636
Observations	2,766		
McFadden's adjusted R2	0.069		
Correctly predicted (percentage)	62.55		

**Table XIII**  
**Importance of Luck and the Decision to Start an Entrepreneurial Career**

The table reports coefficient estimates and corresponding marginal effects ( $\partial f/\partial x$ ) of probit regressions that model the entrepreneurial career decision. The regression specification is the same as that used for the selection equation in Table IV, except for the addition of the scores related to the success factors in entrepreneurial performance. The dependent variable takes the value of 1 if an individual is an entrepreneur, and zero otherwise. Entrepreneurs are individuals who work at least part-time in a company in which they hold a financial stake. Column (1) tests the relevance of the success factors using the scores that these factors receive from the entrepreneurs. The possible scores range from very important (5) to very unimportant (1). High (low) balanced management education is a binary variable equal to 1 if the individual's experience is in the highest (lowest) quartile of the sample distribution, and equal to zero otherwise. The remaining columns replace the subjective assessments of the importance of the success factors with proxies for the actual value of those factors. All regressions include nondisclosure dummies. Variable definitions are provided in the Appendix. Asterisks denote statistical significance at the 1% (\*\*\*) , 5% (\*\*), or 10% (\*) level (two-sided tests).

Regression arguments	(1)		(2)		(3)		(4)	
	Coefficient	$\partial f/\partial x$	Coefficient	$\partial f/\partial x$	Coefficient	$\partial f/\partial x$	Coefficient	$\partial f/\partial x$
<i>Success factors: subjective scores</i>								
Importance of luck	-0.049***	-0.018	-0.040**	-0.014	-0.040***	-0.014	0.000	0.000
Importance of luck*High balanced management education					0.040***	0.014		
Importance of luck*Low balanced management education							-0.040***	-0.014
Importance of experience	0.041	0.015						
Importance of talent	0.013	0.005						
Importance of hard work	0.192***	0.069						
Importance of education	-0.168***	-0.060						
Importance of connections	0.130***	0.047						
<i>Success factors: actual values</i>								
<i>Hard work</i>								
Number of children			-0.080***	-0.028	-0.081***	-0.028	-0.081***	-0.028
<i>Experience</i>								
Work experience			0.005*	0.002	0.005	0.002	0.005	0.002
Management experience			0.014***	0.005	0.014***	0.005	0.014***	0.005
Industry experience			-0.011***	-0.004	-0.011***	-0.004	-0.011***	-0.004
<i>Talent</i>								
Previously unemployed			0.562***	0.215	0.560***	0.214	0.560***	0.214
Previously successful entrepreneur			0.082*	0.029	0.074*	0.026	0.074*	0.026
Previously unsuccessful entrepreneur			0.279***	0.103	0.273***	0.101	0.273***	0.101
<i>Education</i>								
Education			0.023***	0.008	0.025***	0.009	0.025***	0.009
Balanced mgmt education			0.084***	0.029	0.047**	0.017	0.047**	0.017
<i>Connections</i>								
Connections			0.357***	0.133	0.353***	0.131	0.352***	0.131
<i>Personal characteristics</i>								
Internal locus of control	0.173***	0.063	0.139***	0.050	0.149***	0.054	0.149***	0.054
Overconfidence	1.184***	0.425	1.136***	0.399	1.141***	0.401	1.141***	0.401
Risk-aversion	-0.558***	-0.200	-0.447***	-0.157	-0.440***	-0.154	-0.440***	-0.154
Married	-0.152***	-0.055	-0.049	-0.017	-0.049	-0.017	-0.049	-0.017
Divorced	0.054	0.020	0.135**	0.049	0.136**	0.049	0.136**	0.049
Female	-0.435***	-0.146	-0.395***	-0.130	-0.409***	-0.134	-0.409***	-0.134
Foreigner	0.255***	0.095	0.299***	0.110	0.296***	0.109	0.296***	0.109
Age	0.066***	0.032	0.061***	0.021	0.063***	0.022	0.063***	0.022
Age squared	-0.001***	-0.063	-0.001***	-0.000	-0.001***	-0.000	-0.001***	-0.000
Protestant	0.090***	-0.165	0.090***	0.024	0.067**	0.024	0.067***	0.024
French culture	-0.178***	0.063	-0.233***	-0.079	-0.234***	-0.079	-0.234***	-0.079
Italian culture	-0.526***	0.425	-0.362***	-0.116	-0.371***	-0.118	-0.371***	-0.118
<i>Identification variables</i>								
Career by chance	0.262***	0.092	0.192***	0.066	0.176***	0.061	0.176***	0.061
Motivation achievement	0.135***	0.049	0.069*	0.024	0.066*	0.023	0.066*	0.023
Log(net wealth)	0.069***	0.025	0.050***	0.017	0.049***	0.017	0.049***	0.017
Previously employed in a small firm	0.486***	0.178	0.493***	0.177	0.496***	0.178	0.498***	0.178
Entrepreneurial parents	0.085**	0.031	0.055	0.020	0.057	0.020	0.057	0.020
Formation-year dummies	Yes		Yes		Yes		Yes	
Industry controls	Yes		Yes		Yes		Yes	
Number of observations	8,245		8,245		8,245		8,245	
McFadden's adjusted R2	0.247		0.270		0.270		0.270	
Correctly predicted (percentage)	75.80		76.42		76.39		76.39	

**Table XIV**  
**Importance of luck and entrepreneurial decision making**

The table reports the estimation results of probit regressions that study entrepreneurial decision making. The sample is restricted to current entrepreneurs. Panel A studies the decision to tap the entrepreneur's pension fund assets to fund the firm. The dependent variable equals 1 if the entrepreneur has used at least part of those assets to do so, and it equals 0 otherwise. In the regression, *initial capital* equals 1 if it is larger than the median in the industry and year in question, and 0 otherwise. Panel B investigates the decision to work part-time. Entrepreneurs were asked whether they had another job besides that in the firm. The dependent variable equals 1 if the entrepreneur works only part-time in the firm, and it equals 0 otherwise. Panel C tests whether entrepreneurs who believe in the importance of luck for success also want to be prepared for unexpected events. The respondents were confronted with the following statement: *As entrepreneurs, we do not want to eliminate chance, but we want to be well prepared for it.* The dependent variable equals 1 if the entrepreneur answered: I fully agree or I almost fully agree. The dependent variable equals 0 otherwise. In addition to those shown in the panels, the control variables include those in regression model (2) and the identification variables. All regressions include nondisclosure dummies. Variable definitions are provided in the Appendix. Asterisks denote statistical significance at the 1% (\*\*\*) , 5% (\*\*), or 10% (\*) level (two-sided tests).

<i>Panel A: Use of pension fund assets to finance the firm</i>						
Sample characteristic	Proprietorships			Corporations		
	Coefficient estimate	z-value	Marginal effect	Coefficient estimate	z-value	Marginal effect
Importance of luck	-0.169***	-3.791	-0.062	-0.137*	-1.748	-0.027
Importance of luck * Initial capital	0.019***	6.236	0.007	0.010*	1.768	0.002
Overconfidence	0.836***	4.452	0.306	0.391	1.426	0.076
Risk aversion	-0.101	-0.618	-0.037	-0.246	-0.966	-0.048
Number of observations		1,341			937	
McFadden's Adj. R <sup>2</sup>		0.069			-0.056	

  

<i>Panel B: Part-time employment</i>						
	Proprietorships			Corporations		
	Coefficient estimate	z-value	Marginal effect	Coefficient estimate	z-value	Marginal effect
Importance of luck	0.073**	1.983	0.022	0.053	1.201	0.017
Overconfidence	-0.309	-1.501	-0.094	0.415*	1.699	0.138
Risk aversion	-0.274	-1.604	-0.084	0.177	0.808	0.059
Number of observations		1,344			934	
McFadden's Adj. R <sup>2</sup>		0.087			0.088	

  

<i>Panel C: Being prepared for chance</i>									
	Full sample			Proprietorships			Corporations		
	Coefficient estimate	z-value	Marginal effect	Coefficient estimate	z-value	Marginal effect	Coefficient estimate	z-value	Marginal effect
Importance of luck	0.223***	9.39	0.063	0.270***	7.226	0.076	0.180***	4.088	0.051
Overconfidence	0.112	0.873	0.032	0.386	1.337	0.092	-0.049	-0.165	-0.014
Risk aversion	-0.057	-0.502	-0.016	-0.073	-0.426	-0.021	0.019	0.088	0.005
Number of observations		3,035			1,332			940	
McFadden's Adj. R <sup>2</sup>		0.082			0.122			0.136	



**Table XV**  
**Performance of Entrepreneurial Firms and Subjective Luck**

This table reports estimates of the performance regression (1) in the text. Because entrepreneurs are unlikely to be drawn from a random sample of individuals, we perform the analysis with a Heckman two-stage estimation procedure. We therefore use the model of entrepreneurial career choice in equation (2) as the first stage using the estimates in column (2) of Table XIII (without the importance of luck variable). In the second-stage, we estimate the performance regression (1) with the addition of the inverse Mills ratio from the first stage. Furthermore, we include two variables that measure whether the entrepreneur believes his or her firm has done unexpectedly well or unexpectedly poorly (*good luck* and *bad luck*). Entrepreneurs are individuals who work at least part-time in a company in which they hold a financial stake. All regressions include nondisclosure dummies. Variable definitions are in the Appendix. Asterisks denote statistical significance at the 1% (\*\*\*), 5% (\*\*), or 10% (\*) level (two-sided tests).

Dependent Variable:	Industry- and formation-year- adjusted log(firm sales)	
	Coefficient	z-Statistic
<i>Entrepreneurial luck</i>		
Good luck	0.568***	11.152
Bad luck	-0.573***	-7.292
<i>Success factors: actual values</i>		
<i>Hard work</i>		
Number of children	0.040*	1.883
Part-time entrepreneur	-0.327***	-5.842
<i>Experience</i>		
Work experience	-0.005	-1.417
Management experience	0.011***	2.984
Industry experience	0.005*	1.941
<i>Talent</i>		
Previously unemployed	-0.273**	-2.047
Previously successful entrepreneur	0.037	0.617
<i>Education</i>		
Education	-0.003	-0.322
Balanced management education	0.034*	1.885
<i>Connections</i>		
Connections	-0.074	-1.075
<i>Personal characteristics</i>		
Internal locus of control	0.028	0.502
Overconfidence	0.124	1.005
Risk-aversion	-0.022	-0.211
Married	0.142**	2.309
Divorced	0.074	0.768
Female	-0.250***	-3.549
Foreigner	-0.016	-0.230
Age	0.042**	2.378
Age squared	-0.000**	-2.444
Protestant	-0.049	-1.022
French culture	0.169***	2.762
Italian culture	0.087	0.734
<i>Firm-specific controls</i>		
Equity ownership	-0.005***	-4.669
Sole proprietorship	-0.613***	-10.693
Log(initial capital)	0.077***	8.310
Log(employment)	0.269***	15.824
Venture-capital-backed	0.022**	2.038
Formation -year dummies		Yes
Industry dummies		Yes
Inverse Mills ratio ( $\lambda$ )	-0.223**	-2.144
Number of observations		2,349
Adjusted R-squared		0.418

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