Luck and Entrepreneurial Success

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Working Paper No.
FR 17-20

18 Aug 2017

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Luck and Entrepreneurship[◊]

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February 2017

Abstract

What is luck in the opinion of entrepreneurs, how does it affect decisions, and what role does it play in firm performance? For an answer we rely on a unique survey of 63,202 individuals. Luck perceptions shape decisions. Individuals who believe luck is important are reluctant to become entrepreneurs, and those who do exhibit lower commitment. Luck perceptions also play a crucial role in important entrepreneurial activities. Interestingly, however, luck perceptions rank last in importance among various determinants of overall entrepreneurial performance. One possible reason is that entrepreneurs do not generally pursue radically new ideas but replicate ideas seen elsewhere.

Keywords: luck, start-ups, entrepreneur, factors of success, performance
JEL codes: G3, G02, M13

Luck is everything... My good luck in life was to be a really frightened person. I'm fortunate to be a coward, to have a low threshold of fear, because a hero couldn't make a good suspense film.[1]

Alfred Hitchcock, Director

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." Countless researchers from many disciplines have wondered about the same question. Most recently, for example, a *Science* article by biologists Tomasetti and Vogelstein (2015) concluded that "only a third of the variation in cancer risk among tissues is attributable to environmental factors or inherited predispositions. The majority is due to «bad luck»."[2] Not surprisingly, the topic surfaces quite frequently in connection with business success. Was it good luck that helped entrepreneurs like Sam Walton and Bill Gates grow from tiny operations to gigantic corporations? Was it skills or good luck that propelled the success of Warren Buffett and Peter Lynch?

The purpose of this paper is to study the role of luck in entrepreneurial careers. We investigate whether luck perceptions discourage people from becoming entrepreneurs, how these perceptions affect subsequent managerial decisions, how much luck is believed to affect performance, and what entrepreneurs mean by luck to begin with. In keeping with the literature, we define luck as the unexpected component of performance (e.g., Bertrand and Mullainathan (2001); Kahneman (2011)). However, it is not clear whether and how much of the residual error in a model of performance truly reflects luck. For example, we do not know the model's correct

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[1] http://www.brainyquote.com/quotes/quotes/a/alfredhitc408681.html

[2] Tomasetti and Vogelstein (2015), p. 78.

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functional form, nor do we know all of the relevant variables and their proxies. Equally important, the value taken by the determinants of performance is itself a matter of luck: being, for example, in the right industry at the right time, or having the resources to enter a given market could be the result of rational planning, but it could also be fortuitous. Hence, it is not clear how one should objectively measure luck. We therefore resort to a subjective measure and investigate what entrepreneurs themselves believe. The justification is that, ultimately, it is perceptions and beliefs that determine behavior (e.g., Baum, Locke, and Smith (2001); Hmieleski and Baron (2009)).

To the best of our knowledge, this is one of the first empirical studies to attempt an appraisal of the importance of luck in entrepreneurial decisions and entrepreneurial performance.[3] Significant exceptions are Gompers, Kovner, Lerner, and Scharfstein (2010) and Kaplan, Klebanov, and Sorensen (2012). 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 only strand of the literature where the issue of luck is central is the investment literature, starting with Fama, Fisher, Jensen, and Roll (1969). For example, 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) and Barras, Scaillet, and Wermers (2010) maintain that most of the variation in mutual fund abnormal performance is driven by luck.

The basis for our investigation is a 2007 survey of 63,202 individuals in Switzerland. A total of 8,245 individuals participated in the survey. About one third of them were entrepreneurs

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[3] A theoretical model in which agents have to distinguish between luck and abilities is in Landier (2006).

who had registered their businesses between 2002 and 2006, the rest were non-entrepreneurs, including teachers, engineers, managers, and public employees. The personal characteristics of our sample of entrepreneurs are similar to those of the sample in Bitler, Moskowitz, and Vissing-Jørgensen (2005). Various biases can affect a survey, even though we designed ours in such a way as to limit their influence. Throughout the investigation, we perform a battery of tests to assess the presence of bias. We find 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, many of the regression results are compatible with those reported in the literature that uses non-survey data, which gives us confidence that our survey provides reliable inferences.

Switzerland would seem to be an attractive place to study entrepreneurial motivations and performance. According to various indices, Switzerland ranks at the very top in terms of innovation, entrepreneurial activity, and competitiveness. For example, the *Global Innovation Index 2014*, published jointly by Cornell University, INSEAD, and the World Intellectual Property Organization assigns Switzerland the top spot as the most innovative nation in the world. Switzerland is also at the forefront in terms of entrepreneurship. The *Global Entrepreneurship and Development Index 2015,* issued by the Imperial College Business School in the UK, lists it as one of the world's top ten countries in terms of entrepreneurial activity. Finally, Switzerland is one of the most competitive economies in the world. It tops the overall rankings of the *Global Competitiveness Report 2014-2015*, which is published by the World Economic Forum.

We study the contribution of luck in four phases of the entrepreneurial career, namely the decision to start a company, the commitment of the entrepreneur, the success of individual

management activities, as well as the overall performance of start-up companies. Moreover, we examine what entrepreneurs have in mind when they mention luck. We first test whether an individual's attitude toward luck affects his career choice. To find out, we asked participants to indicate the importance of luck for business success. The more strongly a risk-averse individual believes that success is driven by random chance, the more reluctant she should be to opt for an entrepreneurial career, as suggested by the experimental evidence in Camerer and Lovallo (1999). We therefore test in a multivariate framework whether the prospect of being exposed to chance discourages an entrepreneurial career. The evidence strongly supports this prediction. The effect is tangible and holds conditional on a broad set of control variables that include age, gender, experience, talent, education, risk aversion, and overconfidence among many others. According to our estimates, the marginal impact of luck is comparable in magnitude to the importance of experience, age, net wealth, or family background.

Luck perceptions have potential implications for entrepreneurial behavior that go beyond career choices. The second part of the paper therefore investigates to what extent luck perceptions shape entrepreneurial commitment. Entrepreneurs can lower their exposure to luck by working only part-time for their firm. The evidence supports this prediction.

The third part of the paper investigates whether luck affects entrepreneurial activities and what particular management activities are perceived to be more dependent on luck. Activities that are objectively more exposed to random events should also be perceived to be more exposed. Consistent with that, gaining customers, finding the business idea, and establishing business connections are activities in which luck plays a very important role according to entrepreneurs. In comparison, finding suppliers and securing financing are activities that are

comparatively less dependent on luck. Overall, close to 60% of the respondents note that luck plays a very significant role in at least one of these activities.

The ultimate question, however, is how much luck is believed to affect overall performance. In step four of the investigation, we therefore investigate to what extent entrepreneurs believe that overall performance depends on luck. We ask respondents to rank the importance of six determinants of firm performance, namely experience, talent, hard work, education, business connections, and luck. According to the answers, luck does matter. Yet it is the least important determinant. Moreover, based on the results of a principal components analysis, luck explains 22% of entrepreneurial performance variation at best.

Perceptions, however, could be colored by personal history and characteristics. Successful entrepreneurs could be blinded by their achievements 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. We investigate whether risk perceptions are biased. 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. To test whether entrepreneurs simply have a distorted view of reality, we also ask non-entrepreneurs. Yet their responses lead to very similar inferences—luck is the least important success factor.

Finally, we test whether, consistent with what we ask them, entrepreneurs really interpret luck as unexpected performance. To find out, we estimate a model of entrepreneurial performance similar to that in Bitler, Moskowitz, and Vissing-Jørgensen (2005) and Gompers et al. (2010). When we regress industry-adjusted sales on various proxies for skills, personal

characteristics, and firm characteristics, 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. More important, we find that what entrepreneurs believe is good luck correlates positively and significantly with unexpected performance variation, and what is believed to be bad luck correlates negatively with that variation. The results are the same with alternative measures of performance. These findings are unable to reject the hypothesis that when entrepreneurs talk about luck they mean unexpected performance.

Overall, we therefore find that luck perceptions discourage entrepreneurial careers, that they affect management decisions and their outcomes, and that performance depends on luck, but also, and especially, on things like experience, talent, and hard work.

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 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)). Luck, however, does play a role in performance and in the outcome of individual management decisions. 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. Fourth, 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.

The rest of the paper proceeds as follows. The next section discusses the survey and the sample characteristics. Section 3 asks whether luck perceptions affect the entrepreneurial decision. Section 4 investigates how these perceptions shape the commitment of entrepreneurs. Section 5 examines whether luck plays a role in various individual management activities. Section 6 inquires into the importance of luck in perceived firm performance. Section 7 investigates whether luck perceptions are related to unexpected performance. Finally, Section 8 concludes.

2   Sample Description and Characteristics

2.1   Sample Selection and Survey Administration

The survey was conducted in Switzerland in late 2007. Two questionnaires were used: one for entrepreneurs and one for a control group of managers and employees (both questionnaires are available from the authors upon request). Following Bitler, Moskowitz, and Vissing-Jørgensen (2005) and Landier and Thesmar (2009), we identify entrepreneurs as individuals with an equity participation in the firm they work for. We also apply the narrower definition by Gompers, Lerner, and Scharfstein (2005) that requires that entrepreneurs also be the firm's founders or cofounders. 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 review of the existing literature, we drafted a first version and circulated it

among a group of academics for feedback. We revised the questionnaire and then sought the advice of communication, marketing, and psychology scholars on survey design and administration. In particular, we discussed measures to increase the response rate and minimize possible response biases. Thereafter, we pre-tested the questionnaire with a group of entrepreneurs and managers. The final questionnaire 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 Commercial Register, Switzerland's official business registry. To make sure these individuals remembered the information we were seeking, we focused on recently founded firms, namely those founded in 2002, 2004, or 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 information, current company data, professional background and education, personal characteristics, opinions about luck, social environment, and personal financial circumstances. The document was nine pages long and contained 54 questions, most of them with subparts.

To obtain a control group, we randomly picked 23,202 individuals, namely managers and other employees (public employees, teachers, engineers, mechanics, and commercial clerks) from the official telephone guide. For this sample, we used profession as strata. That questionnaire contained the same questions as the one for entrepreneurs, except for the two company-related sections and for three additional questions: one about the profession, one about the current employer, and one about whether the respondent ever founded a company. The questionnaire for the control group was six pages long. Both questionnaires promised strict

anonymity. Because Switzerland has three main languages, each questionnaire had a German, a French, and an Italian version.[4]

To increase the response rate, a cover letter and a postage-paid return envelope were included. As an incentive to participate, respondents could order a survey report. After two weeks, people were sent a reminder and were given the possibility of obtaining a new copy of the questionnaire. 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 (e.g., 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 (e.g., Bosma, Van Praag, Thurik, and De Wit (2004); Forbes (2005)).[5] Of the 8,245 respondents, 3,099 were entrepreneurs according to the broader definition whereas 2,778 were entrepreneurs according to the more restrictive definition. The control group includes 5,141 individuals. 4,410 individuals filled out the questionnaire completely. Appendix 2 examines the representativeness of the sample of entrepreneurs compared to the overall population of firms in the Commercial Register in terms of founding year and legal form. Based on the results, we cannot reject the hypothesis that the sample is representative of the population of entrepreneurs.

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[4] 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."

[5] 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.

2.2 Sample Description

The entrepreneurs we survey are typically the founders and principal owners of their companies. 89% of them founded the firm, 4% inherited it, and the rest bought it from someone else. In 78% of the cases, the firm was funded initially by the founder alone. In total, initial equity financing was 87% by the founder himself, 9% by family and friends, 1% by strategic investors, and 1% by business angels or venture capitalists. Table I reports descriptive statistics about the entrepreneurs and their companies. About 44% of the firms are sole proprietorships, 31% are LLCs, and 24% 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. 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 management. 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 CHF 118,000.

By construction, our sample firms are very small. 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 and the average 6. Other countries have similar firm-size distributions. For example, the 2006 *Economic Census* reports that 61% of the firms in the U.S. have between 0 and 4 employees and less than 2% have more than 100 employees. As shown further down, the sample of U.S. entrepreneurs in Bitler, Moskowitz, and Vissing-Jørgensen (2005) has also very similar size characteristics. So does the study by Robb and Robinson (2012) mentioned above.

In line with Bitler, Moskowitz, and Vissing-Jørgensen (2005), entrepreneurs hold a large fraction of their firm's equity. The median ownership is 100% and the lower quartile is 80%. A restricted number of entrepreneurs have less than 20% 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.

With respect to financing policy, 74% of the proprietorships claim to have no debt at all, compared to 66% in LLCs, and 59% in corporations (not shown). Sixty firms in the sample, namely about 2%, have VC or business-angel financing. This is higher than the 0.1% reported in Asker, Farre-Mensa, and Ljungqvist (2015) for the U.S.

Twenty-nine percent of the entrepreneurs work part-time for their firm, and 4% were unemployed before starting. Twenty-seven percent are repeat entrepreneurs. Of these, 76% claim to have been successful and 24% unsuccessful before. 91% have previously worked for a firm (not shown). The companies that acted as incubators are fairly evenly distributed across firm size: 24% of the entrepreneurs worked for companies with more than 250 employees, and 29% for companies with fewer than 10 employees (not shown).

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

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, more overconfident, and they tend to be male (82 vs. 74%). But there is little actual difference in terms of, for example, management experience, education, business network, or net wealth. The personal characteristics of the entrepreneurs surveyed by Bitler, Moskowitz, and Vissing-Jørgensen (2005) are very similar.

Appendix 3 looks for traces of non-response, survivorship, and self-selection bias. According to the evidence, our sample does not seem to be systematically affected by these biases.

2.3   Luck Perceptions

Our primary dimension of interest is the respondents' attitude towards luck. To find out, 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 answers 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 subjective 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 absolute scores instead.

12

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 infer that the six factors in the question are quite exhaustive.

3 Luck Perceptions and the Entrepreneurial Decision

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).

3.1 Luck and the Propensity to become an Entrepreneur

We model the entrepreneurial career decision with the probit regression:

(1) *Entrepreneur$_i$ = f(perceived importance of luck, perceived importance*

of other success factors, personal characteristics, identification variables)$_i$ + ε_i ,

where v_i is a standard disturbance term, and *Entrepreneur* is a binary variable that identifies individuals who are entrepreneurs. The specification of the function f(.) is 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). We include the perceptions of luck and the perceptions about the importance of the other success factors mentioned above. However, whereas we expect luck perceptions to discourage entrepreneurship, we cannot predict the sign of the impact of the other factors. Believing, for example, that education is important might encourage educated individuals into joining the entrepreneurial

ranks, but it will deter uneducated people. The regression specification includes five variables, which, at a later stage of the analysis, will serve as identification variables in a selection model to explain entrepreneurial performance.[6]

To maximize the number of observations in the 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 with missing observations itself is given a value of zero for the respondents who don't provide the information in question. All results remain qualitatively the same when we exclude observations with missing data.

The results are in Table III.[7] 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. There are 8,245 observations, the McFadden's adjusted R-squared is 27%, and 76% of the observations are correctly predicted. 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 the entrepreneurial career path.

The evidence also shows that perceptions about the importance of the other success factors matter as well. Individuals who believe hard work and connections are important are more likely

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[6] 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)). The final two variables are the 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.

[7] Table IVshows the correlation matrix of the variables used in the regression analysis.

to become entrepreneurs, 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, possibly because these people feel they lack the appropriate education or because they have a comparatively higher expected salary in traditional career paths. Note that the marginal effects of these variables are larger than the effect associated with luck. The perceived importance of experience and talent, however, is unrelated with the entrepreneurial decision.

In column (2) of the table, we want to know whether perceptions about success factors are supported by facts. We therefore replace all perceptions except that about the importance of luck with proxies for the actual individual success factors themselves. We use the following proxies:

a) Hard work: number of children and part-time entrepreneur. These two proxies should be inversely related with hard work;

b) Experience: actual work, industry, and management experience;

c) Talent: previously unemployed and previously successful entrepreneur;

d) Education: education and balanced management education;

e) Connections: connections.

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 the 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 even has

a negative coefficient, possibly because industry-specific experience is associated with better remuneration, which raises the opportunity costs of entrepreneurship. There is also only weak evidence that talented individuals are more likely to choose an entrepreneurial career. Furthermore, previously successful entrepreneurs are marginally more likely to get involved in another start-up. But previously unsuccessful entrepreneurs, and, therefore, presumably less talented entrepreneurs, tend to try again as well.

Strictly taken, since we use cross-sectional data, equation (1) does not model the decision to become an entrepreneur but rather the probability of being one. Being an entrepreneur is the result of both a career decision and of the probability of survival (Evans and Leighton (1989)). However, 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, survival should not be a factor. This short timeframe should also help discard the potential concern that the respondents' might not remember their original motivations to become entrepreneurs or might have experienced a change in preferences.

3.2 Control Variables

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). 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 remaining control variables have all positive and significant coefficients. Higher net wealth (e.g. Holtz-Eakin, Joulfaian, and Rosen (1994a), Corradin and Popov (2015)), being prone to making career choices by chance, having a stronger motivation achievement (Lynn (1969); Zhao and Seibert (2006)), having been employed in a small firm (Gompers, Lerner, and Scharfstein (2005); Sørensen (2007)), and having entrepreneurial parents (Blanchflower and Oswald (1998)) all favor an entrepreneurial career.

4   Attitude towards Luck and Entrepreneurial Commitment

The second step of the investigation is to test whether luck perceptions influence entrepreneurial commitment. The available data enable the analysis of the willingness to work full-time.[8] In

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[8] 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).

Table V, we therefore investigate that particular decision with a probit regression and the standard specification. The dependent variable equals 1 if the entrepreneur works part-time, and it equals 0 otherwise. As mentioned above, some legal forms, in particular corporations, require a minimal initial capital commitment. Hence, there could be self-selection, in the sense that start-ups with the legal form of corporations tend to be more promising firms and consequently companies that it pays the entrepreneur to spend time on. To address this concern, we therefore distinguish between proprietorships and corporations. 27% of the entrepreneurs in proprietorships work only part-time, compared with 30% in corporations. If that decision reflects concerns about the exposure to random events, the variable *Importance of luck* should have a positive and significant coefficient. That is indeed what we find. In contrast, that coefficient is statistically zero when we repeat the investigation for corporations.

5   Luck in Individual Entrepreneurial Activities

Next we investigate the role of luck perceptions in individual entrepreneurial decisions. The questionnaire asked respondents to indicate the importance of luck in eight different management areas, namely:

a) the identification of the right business idea;

b) the decision of when to enter the market;

c) the hiring of employees;

d) the gaining of customers;

e) the securing of suppliers;

f) the obtaining of financial support;

g) the establishing of business connections;

h) and the creation of private connections.

Table VI reports summary statistics. 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. In contrast, 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). Overall, however, there are aspects of entrepreneurial activities in which luck appears to matter in a significant way. In fact, close to 60% of the responding entrepreneurs claim that luck plays a very significant role in at least one of the eight activities in question; 40% do so for at least two tasks; 25% for at least three; and 16% for at least four (Panel B). Thus, and contrary to pervasive self-attribution, the majority of entrepreneurs view luck as being very important in at least one main management area.

6   Luck and Perceived Firm Performance

The evidence therefore is that luck perceptions affect entrepreneurs' decisions and seem to matter in many managerial activities. The next step is to investigate how luck is believed to ultimately affect performance. To find out, we study the rankings of the six success factors we investigated.

6.1   Rankings of Success Factors

Table VII 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 a 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.

The obvious reservation about these rankings is that they are self-reported opinions, and opinions are bound to be colored by personal circumstances and traits. We therefore test whether there might be bias. The details of that analysis are reported in Appendix 4. Overall, there is some evidence that luck perceptions are distorted by personal situations, abilities, and experience. However, these distortions do not affect luck's relative ranking among success factors. In particular, there is little if any evidence of self-attribution and internal locus (illusion) of control bias. The conclusion that luck ranks last among the six factors of success considered is also supported when we repeat the analysis in a multivariate context using an ordered logit regression (not shown). Moreover, the same conclusion obtains when we replicate the ranking of success factors for the control group of non-entrepreneurs (not shown).

To examine the contribution that luck is believed to make to performance, we use the actual scores that respondents assign to the six success factors in question and conduct a principal component analysis, similar to the procedure of Kaplan, Klebanov, and Sorensen (2012). Panel C of Table VII 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, even if they are all numerically fairly small. If the six

success factors are in fact uncorrelated, it should not be possible to reduce them to a smaller number of principal components, and the perceived contribution of luck to overall performance would consequently be no larger than one sixth, or 17%. The results show that most of the variation in the six factors (66%) is explained by only 3 components (not shown). For a closer analysis, Table VIII 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 the third of three uncorrelated components, which means that it could be responsible for 22% of performance variation at best.

A plausible explanation for this limited role of luck could be that, as pointed out in Bhidé (2000), entrepreneurs do not typically pursue radically new ideas but mostly follow comparatively safe strategies and replicate or modify ideas seen in previous employment.

6.2   The Role of Luck: Individual Management Areas vs. Overall Performance

The question then is why luck is believed to play a significant role in individual management areas but only a limited one in overall performance. 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 that identify entrepreneur who believe luck ranks highest in one of the eight management areas investigated above.

The results are in Table IX. With the exception of financing, all the arguments have a significant coefficient. Furthermore, activities that entrepreneurs believe to be more exposed to luck tend to be also activities with larger coefficients, 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 coefficient. In contrast, establishing private connections and finding employees have both lower rankings and lower coefficients. Obtaining financing and securing suppliers have the lowest rankings and the lowest coefficients. The coefficient associated with suppliers is even negative. Arguably, being lucky enough to find the right suppliers reduces the overall exposure to chance.

7   Perceived Luck and Actual Performance

The survey question referred to luck as unexpected events. The last section of the paper investigates whether what appears to be unexpected to entrepreneurs correlates with the error term of a standard entrepreneurial performance model.

7.1   *Entrepreneurial Performance Regression*

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. The results are the same when we measure performance alternatively with the industry-adjusted annual return on initial capital (not shown). 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 this performance metric at the 1ˢᵗ and 99ᵗʰ percentiles of its distribution. Moreover, consistent with Bitler, Moskowitz, and Vissing-Jørgensen (2005), we exclude all firms with zero sales in the regression analysis. The entrepreneurial performance model we use borrows from the entrepreneurship literature (see, among others, Bitler, Moskowitz, and Vissing-Jørgensen (2005) and Gompers et al. (2010)). Formally, we estimate the following cross-sectional regression:

(2)   *Performance$_i$ = g(entrepreneurial skills, personal characteristics,*

   firm-specific control variables)$_i$ + ε$_i$,

where ε$_i$ is a disturbance term with the standard properties, and the subscript refers to firm i in the sample. The results are robust to various nonlinearities and interaction terms.

As we have seen, entrepreneurs are unlikely to be drawn from a random sample of individuals. Therefore, we perform the analysis with a Heckman two-stage estimation procedure. Entrepreneurs might possess unobserved characteristics related to entrepreneurial performance, a situation that could bias the estimates of equation (2) (Hamilton (2000)). To correct for this potential sample selection problem, we first model the decision of pursuing an entrepreneurial career using the specification (1) described above. In the second stage, we estimate the performance regression (2) with the addition of the inverse Mills ratio from the first stage as a regression argument.

7.2   Perceived Luck and Unexplained Performance

To find out whether what appears to be unexpected to entrepreneurs correlates with unexplained performance, we add a subjective measure of unexpected performance to regression (2) and test whether the explanatory power of the regression goes up. However, we need a subjective

measure of unexpected performance that is specific to the entrepreneur's current firm. The variable *Importance of luck* that we used so far does not do because it relates to a generic question about performance factors not necessarily related to the entrepreneur's current firm. Instead, we need a subjective assessment of the current firm's success. We therefore 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). In 37% of the cases, entrepreneurs say they had good luck, in 13% they say they had bad luck. The remaining 50% said they performed as expected. If perceived luck is related to unexplained performance, the two proxies should raise the explanatory power of the performance model. Furthermore, whereas *good luck* should have a positive coefficient, *bad luck* should have a negative one.

The evidence in Table X confirms all three predictions. *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 essentially identical: the coefficient of *good luck* is 0.568, and that of *bad luck* is −0.573. The two luck variables have tangible explanatory power. 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 X are mostly consistent with those reported in the literature with secondary data, a finding that lends support to the validity of our survey data. In particular, various success factors covered 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 effort 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).[9]

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

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[9] The finding that *previously successful entrepreneur* is unrelated with performance seems to contradict Gompers et al. (2010) who find performance persistence among previously successful entrepreneurs. Previous success, however, could be a proxy for variables included here but not in their study, such as management experience and management education.

the factors that rank lower, namely education and connections, only education has a marginal influence, and only in the form of balanced management education.

8   Conclusions

According to our survey, luck is the least important success factor, 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. A more promising explanation of our results is that entrepreneurs do not generally pursue radically new ideas (Bhidé (2000)).

The results have implications for many players in the market for start-ups. For academics, they show that entrepreneurs are aware of randomness 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 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 1: Variable Definitions

Variable	Description
Panel A: Measures of luck	
Career by chance	Binary variable equal to 1 if the individual claims his/her career occurred by chance, and equal to 0 otherwise;
Good luck	Binary variable equal to 1 if the entrepreneur claims his/her current business performed better than expected, and equal to 0 otherwise;
Bad luck	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;
Importance of luck	The score given to luck by survey participants. The possible score ranges from very important (5) to quite unimportant (1).
Importance of luck (bin)	A binary variable equal to 1 if respondents give *importance of luck* a score of 5 or 4, and equal to 0 if they give a score of 3, 2 or 1.
Panel B: Measures of skills	
Education	Years of education, as in Parker (2004);
Balanced management education	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;
Age	Number of years since birth;
Work experience	Years of work experience, as in Parker (2004);
Industry experience	Years of work experience in the firm's industry, as in Evans and Leighton (1989);
Management experience	Years of management experience, as in Kim, Aldrich, and Keister (2006);
Connections	Binary variable equal to 1 if the entrepreneur is a member of a business network, and equal to 0 otherwise.
Panel C: Measures of personal characteristics	
Risk aversion	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);
Overconfidence	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;
Motivation achievement	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);
Internal locus of control	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));
Previously employed in a small firm	Binary variable equal to 1 if individual previously worked in a small firm, and equal to 0 otherwise;
Part-time entrepreneur	Binary variable equal to 1 if the entrepreneur has another job, and equal to 0 otherwise;

Variable	Description
Panel D: Firm-specific control variables and other variables	
Ownership	Entrepreneurial ownership in percent, as in Bitler, Moskowitz, and Vissing-Jørgensen (2005);
Net wealth	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;
Sole proprietorship	Binary variable equal to 1 if firm is a sole proprietorship, and equal to 0 otherwise;
Initial capital	Capital raised at the start of the company, adjusted for the formation year of the company by compounding at the risk free rate;
Current equity	Firm equity;
Employment	Current number of employees;
Leverage	Current debt/equity ratio;
Venture capital backed	Binary variable equal to 1 if firm is venture capital or business angel backed;
Protestant	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	
Industry-adjusted log(sales)	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.

Appendix 2: Representativeness of the Sample

Table AI examines how representative the sample of entrepreneurs is compared to the overall population of firms in the 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%. The exceptions are corporations in 2004 with 3% sample underrepresentation, and companies with limited liability (LLCs) in 2006 with 2.5% sample overrepresentation.

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%, –4%, 4%, and 11%, respectively. In the case of mechanics, however, the deviation is 16% (mechanics are only 11% 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).

Table AI: Representativeness of Entrepreneur Sample

Legal form	Founding year	Number popu-lation firms	(3) as fraction of total popu-lation	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		

Appendix 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), 80.7% of the firms that are started at any time are still operating one year later, 69.8% after two years, and only 50.0% 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% 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 analysis shows that the subjective rankings of success factors, the main variable of interest here, do not depend on performance.

There are two further concerns. One is 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 important, our results are similar to those reported in the literature. The second concern is 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% did so. Dropping these individuals from the sample has no material effect on the conclusions (not shown).

Appendix 4: Scoring Bias and Perceived Role of Luck for Firm Performance

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. The results of the analysis are shown in Table AII.

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 are classified as 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.

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 the table 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.

Panel C of Table AII 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% of the entrepreneurs with a German background think they don't need luck to succeed, compared with 53% 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 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 rankings remain 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).

Table AII: Rankings of Success Factors

Panel A: Split by firm performance

	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

Panel B: Split by locus of control

	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

Panel C: Split by cultural region

	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

Panel D: Split by religion

	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

Notes: 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 Appendix 1. Asterisks denote statistically significant differences in means at the 10%, 5%, 1% (*, **, ***) level of confidence (two-sided Wilcoxon rank sum tests), respectively.

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Table I: Summary Statistics for Entrepreneurs

Variable	Mean	Min	Median	Max	Standard Deviation	N
Firm-specific variables						
Sole proprietorship	44%	–	–	–	–	3,082
LLCs	31%	–	–	–	–	3,082
Corporations	24%	–	–	–	–	3,082
Initial number of employees (including the entrepreneur)	3	0	1	330	8.66	2,956
Current number of employees (including the entrepreneur)	5.62	0	1.75	1,190	36.76	2,979
Equity in thousands CHF	856	0	118	200,000	7,970	1,332
Ownership (percentage)	85.31	1.00	100.00	100.00	25.91	3,104
Venture-capital- backed (proportion)	2%	–	–	–	–	3,000
Protestant region (proportion)	53%	–	–	–	–	2,956
Personal characteristics						
Part-time entrepreneur	29%	–	–	–	–	3,051
Previously successful	23%	–	–	–	–	3,051
Previously unsuccessful	8%	–	–	–	–	3,051
Former employer: up to 49 employees	52%	–	–	–	–	3,098
German culture	71%	–	–	–	–	3,099
French culture	24%	–	–	–	–	3,099
Italian culture	5%	–	–	–	–	3,099
Firm performance						
Firm sales in thousands CHF	2,010	0	200	2,500,000	48,800	2,697

Notes: Entrepreneurs are individuals who work at least part-time in a company in which they hold a financial stake. Variable definitions are in Appendix 1.

Table II: Sample Averages: Comparison of Entrepreneurs and Non-Entrepreneurs

	All	Entrepreneurs	Non-entrepreneurs	Difference
Entrepreneurial characteristics				
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***
Personal characteristics				
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***
Identification variables				
Net wealth	12.56	12.63	12.52	0.11**
Career by chance	0.67	0.73	0.63	0.10***
Motivation achievement	0.37	0.43	0.33	0.10***
Entrepreneurial parents	0.27	0.32	0.23	0.09***

Notes: 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 Appendix 1.
*** Significant at the 1 percent level.
** Significant at the 5 percent level.
* Significant at the 10 percent level.

Table III: Importance of Luck and the Decision to Start an Entrepreneurial Career

Regression arguments	(1)		(2)	
	Coefficient	∂f/∂x	Coefficient	∂f/∂x
Success factors: subjective scores				
Importance of luck	−0.049***	-0.018	−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		
Success factors: actual values				
Hard work				
Number of children			−0.080***	-0.028
Experience				
Work experience			0.005*	0.002
Management experience			0.014***	0.005
Industry experience			−0.011***	-0.004
Talent				
Previously unemployed			0.562***	0.215
Previously successful entrepreneur			0.082*	0.029
Previously unsuccessful entrepreneur			0.279***	0.103
Education				
Education			0.023***	0.008
Management education			0.084***	0.029
Connections				
Connections			0.357***	0.133
Personal characteristics				
Internal locus of control	0.173***	0.063	0.139***	0.050
Overconfidence	1.184***	0.425	1.136***	0.399
Risk-aversion	−0.558***	-0.200	−0.447***	-0.157
Married	−0.152***	-0.055	−0.049	-0.017
Divorced	0.054	0.020	0.135**	0.049
Female	−0.435***	-0.146	−0.395***	-0.130
Foreigner	0.255***	0.095	0.299***	0.110
Age	0.066***	0.032	0.061***	0.021
Age squared	−0.001***	-0.063	−0.001***	-0.000
Protestant	0.090***	-0.165	0.090***	0.024
French culture	−0.178***	0.063	−0.233***	-0.079
Italian culture	−0.526***	0.425	−0.362***	-0.116
Identification variables				
Career by chance	0.262***	0.092	0.192***	0.066
Motivation achievement	0.135***	0.049	0.069*	0.024
Log(net wealth)	0.069***	0.025	0.050***	0.017
Previously employed in a small firm	0.486***	0.178	0.493***	0.177
Entrepreneurial parents	0.085**	0.031	0.055	0.020
Formation-year dummies, Industry controls	Yes		Yes	
Number of observations	8,245		8,245	
McFadden's adjusted R2	0.247		0.270	
Correctly predicted (percentage)	75.80		76.42	

Notes: The table reports coefficient estimates and corresponding marginal effects (∂f/∂x) of probit regressions that model the entrepreneurial career decision. The dependent variable identifies entrepreneurs. 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). Column (2) replaces 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 Appendix 1.

*** Significant at the 1 percent level.
** Significant at the 5 percent level.
* Significant at the 10 percent level.

Table IV: Correlation Matrix

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)	(23)	(24)	(25)
Education (1)	1.00																								
Balanced management education (2)	**0.12**	1.00																							
Working experience (3)	-0.01	**0.08**	1.00																						
Industry experience (4)	-0.03	0.01	**0.56**	1.00																					
Managerial experience (5)	**0.09**	**0.16**	**0.66**	**0.42**	1.00																				
Previously successful entrepreneur (6)	**0.07**	**0.07**	**0.14**	**0.04**	**0.24**	1.00																			
Previously unsuccessful entrepreneur (7)	-0.01	0.00	0.01	**-0.05**	-0.02	**-0.16**	1.00																		
Good luck (8)	**0.05**	**0.07**	0.01	**0.09**	0.06	0.00	-0.03	1.00																	
Bad luck (9)	-0.01	0.00	-0.01	**-0.09**	**-0.06**	0.00	**0.07**	**-0.30**	1.00																
Risk aversion (10)	**-0.14**	**-0.05**	0.01	0.05	**-0.06**	**-0.08**	0.00	**-0.04**	0.02	1.00															
Overconfidence (11)	0.03	0.01	**-0.06**	**-0.04**	-0.01	**0.05**	0.01	**-0.05**	0.01	**-0.32**	1.00														
Part-time entrepreneur (12)	**0.10**	0.03	**-0.06**	**-0.16**	0.00	**0.13**	0.01	**-0.11**	**0.12**	-0.03	0.01	1.00													
Age (13)	**0.11**	**0.05**	**0.86**	**0.47**	**0.65**	**0.18**	0.03	-0.02	0.02	-0.02	**-0.06**	**-0.04**	1.00												
Previously unemployed (14)	**-0.04**	-0.01	0.03	**-0.05**	**-0.04**	-0.03	**0.06**	**-0.05**	**0.11**	0.01	-0.01	**-0.05**	0.04	1.00											
Female (15)	**-0.09**	0.00	**-0.11**	**-0.14**	**-0.18**	**-0.09**	0.01	-0.02	0.01	**0.04**	**-0.06**	0.00	**-0.08**	0.01	1.00										
Married (16)	**0.04**	0.01	**0.22**	**0.17**	**0.18**	**0.04**	0.00	0.02	**-0.05**	0.00	-0.03	-0.02	**0.25**	-0.01	**-0.08**	1.00									
Divorced (17)	-0.03	0.02	**0.07**	0.02	**0.05**	0.03	0.01	**-0.05**	0.05	-0.01	0.03	0.00	**0.10**	0.05	0.07	**-0.42**	1.00								
Number of children (18)	0.03	-0.01	**0.21**	**0.14**	**0.23**	**0.07**	0.02	**0.04**	-0.04	**-0.07**	0.02	0.02	**0.29**	-0.01	**-0.06**	**0.38**	0.04	1.00							
Foreigner (19)	0.03	**-0.09**	**-0.13**	**-0.07**	**-0.09**	0.00	0.03	**-0.04**	0.00	-0.03	**0.04**	**-0.05**	**-0.09**	0.02	0.02	0.00	0.00	-0.03	1.00						
Ownership (20)	**-0.14**	**-0.10**	0.03	0.04	**-0.05**	**-0.10**	-0.03	-0.02	-0.02	**0.04**	-0.02	**-0.10**	0.02	**0.05**	**0.06**	-0.04	0.05	-0.01	0.02	1.00					
Sole proprietorship (21)	**-0.17**	**-0.14**	**-0.05**	**-0.06**	**-0.16**	**-0.14**	-0.01	**-0.05**	0.02	**0.11**	-0.03	**-0.04**	**-0.06**	**0.10**	**0.14**	**-0.08**	0.05	**-0.06**	0.02	**0.49**	1.00				
Log(initial capital) (22)	**0.04**	**0.06**	**0.05**	**0.05**	0.10	**0.04**	0.00	0.02	0.03	**-0.11**	**0.10**	**-0.04**	**0.06**	-0.01	**-0.09**	0.02	0.02	**0.06**	-0.01	**-0.14**	**-0.19**	1.00			
Log(employment) (23)	**0.04**	**0.09**	0.03	**0.11**	**0.14**	-0.02	-0.01	**0.17**	**-0.16**	**-0.08**	**0.06**	**-0.24**	0.03	**-0.07**	**-0.06**	**0.05**	-0.03	**0.08**	0.01	**-0.13**	**-0.20**	**0.19**	1.00		
Leverage (24)	-0.05	0.01	-0.03	-0.04	-0.04	0.01	0	-0.04	0.04	0	0.02	0.01	-0.04	0.02	-0.03	0	-0.02	-0.01	-0.05	**-0.06**	**-0.10**	**0.11**	-0.01	1	
Venture capital backed (25)	**0.08**	**0.06**	-0.02	-0.03	0.01	0.03	0.03	-0.02	0.02	-0.03	0.02	-0.01	0.00	-0.03	-0.01	-0.01	0.01	-0.01	0.01	**-0.24**	**-0.11**	**0.09**	**0.11**	0.11	1.00

Notes: The table shows the correlation matrix of the variables used in the regression analysis. The sample comprises 2,458 entrepreneurs, defined as individuals who work at least part time in a company in which they hold a financial stake. All variables are defined according to Appendix B. Bold denotes statistical significance with confidence 0.95.

Table V: Importance of Luck and the Decision to Work Part-Time

	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 obs.		1,344			934	
McFadden's Adj. R^2		0.087			0.088	

Notes: The table reports the estimation results of probit regressions that study entrepreneurial decision making. The sample is restricted to current entrepreneurs. The table 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. 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 Appendix 1.
*** Significant at the 1 percent level.
** Significant at the 5 percent level.
* Significant at the 10 percent level.

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

Panel A: Descriptive Statistics

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

Panel B: Number of Activities in which Luck is Very Important

Entrepreneurs who believe luck is important in at least:	Frequency	Percentage
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%

Notes: The table studies 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. Panel A shows descriptive statistics. Panel B examines how many entrepreneurs believe luck is very important in individual management activities. We focus on the instances in which entrepreneurs ranked the importance of luck the highest.

Table VII: Rankings of Success Factors in Entrepreneurial Performance

Panel A: Rankings

Ranking	Mean	St. Dev.	Min	Median	Max	Number of observations
Hard work	1.58	1.18	1.00	1.00	6.00	3,063
Talent	1.61	1.13	1.00	1.00	6.00	3,054
Experience	1.94	1.39	1.00	1.00	6.00	3,055
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
Luck	4.50	1.86	1.00	5.00	6.00	3,018

Panel B: Extreme Rankings

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

Panel C: Kendall Rank Correlation Matrix of Factor Ranks

	Luck	Hard work	Experience	Talent	Education	Connections
Luck	1.00					
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

Notes: Entrepreneurs were asked to provide scores for six factors of entrepreneurial success: luck, experience, talent, hard work, education, and connections. 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.

Table VIII: Principle Component Analysis of Success Factors

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

Notes: The table tests the assumption that the six success factors are uncorrelated. We perform 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.

Table IX: Luck as a Determinant of Success and Luck in Different Management Tasks

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		

Notes: 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 Appendix 1.
*** Significant at the 1 percent level.
** Significant at the 5 percent level.
* Significant at the 10 percent level.

Table X: Performance of Entrepreneurial Firms and Subjective Luck

Dependent Variable:	Industry- and formation-year- adjusted log(firm sales)	
	Coefficient	z-Statistic
Entrepreneurial luck		
Good luck	0.568***	11.152
Bad luck	-0.573***	-7.292
Success factors: actual values		
Hard work		
Number of children	0.040*	1.883
Part-time entrepreneur	-0.327***	-5.842
Experience		
Work experience	-0.005	-1.417
Management experience	0.011***	2.984
Industry experience	0.005*	1.941
Talent		
Previously unemployed	-0.273**	-2.047
Previously successful entrepreneur	0.037	0.617
Education		
Education	-0.003	-0.322
Balanced management education	0.034*	1.885
Connections		
Connections	-0.074	-1.075
Personal characteristics		
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
Firm-specific controls		
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
Inverse Mills ratio	-0.223**	-2.144
Number of observations	2,349	
Adjusted R-squared	0.418	

Notes: 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 (1) as the first stage using the estimates in column (2) of Table III (without the importance of luck variable). In the second-stage, we estimate the performance regression (2) 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 Appendix 1.
*** Significant at the 1 percent level.
** Significant at the 5 percent level.
* Significant at the 10 percent level.