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Abstract

This paper presents evidence of performance persistence in entrepreneurship. We show that entrepreneurs with a track record of success are much more likely to succeed than first-time entrepreneurs and those who have previously failed. In particular, they exhibit persistence in selecting the right industry and time to start new ventures. Entrepreneurs with demonstrated market timing skill are also more likely to outperform industry peers in their subsequent ventures. This is consistent with the view that if suppliers and customers perceive the entrepreneur to have market timing skill, and is therefore more likely to succeed, they will be more willing to commit resources to the firm. In this way, success breeds success and strengthens performance persistence.

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1. Introduction

In this paper, we address two basic questions: Is there performance persistence in entrepreneurship? And, if so, why? Our answer to the first question is yes: all else equal, a venture-capital-backed entrepreneur who succeeds in a venture (by our definition, starts a company that goes public) has a 30% chance of succeeding in his next venture. By contrast, first-time entrepreneurs have only an 18% chance of succeeding and entrepreneurs who previously failed have a 20% chance of succeeding.

The answer to the second question of why there is performance persistence is more complex. Performance persistence – for example, among mutual fund managers, stock analysts, or football players – is usually taken as evidence of skill. This is certainly the most straightforward explanation of our finding. Indeed, we will provide additional evidence to support this view. However, in the context of entrepreneurship, there may be another force at work. The *perception* of performance persistence – the belief that successful entrepreneurs are more skilled than unsuccessful ones – can induce *real* performance persistence. This would be the case if suppliers and customers are more likely to commit resources to firms that they perceive to be more likely to succeed based on the entrepreneur's track record. This perception of performance persistence mitigates the coordination problem in which suppliers and customers are unwilling to commit resources unless they know that others are doing so. In this way, success breeds success even if successful entrepreneurs were just lucky. And, success breeds even more success if entrepreneurs have some skill.

To distinguish between the skill-based and perception-based explanations, it is important to identify the skills that might generate performance persistence. Thus, we

decompose success into two factors. The first factor, which we label "market timing skill," is the component of success that comes from starting a company at an opportune time and place, i.e., in an industry and year in which success rates for other entrepreneurs were high. For example, 52% of computer startups founded in 1983 eventually went public, while only 18% of computer companies founded in 1985 ultimately succeeded. The second factor is the component of success that is determined by the entrepreneur's management of the venture – outperformance relative to other startups founded at the same time and in the same industry. We measure this as the difference between the actual success and the predicted success from industry and year selection. By these measures, an entrepreneur who ultimately succeeded with a computer company founded in 1985 exhibits poor market timing, but excellent managerial skill. One who failed after founding a computer company in 1983 exhibits excellent market timing, but poor managerial skill.

Is starting a company at the right time in the right industry a skill or is it luck? It appears to be a skill. We find that the industry-year success rate in the first venture is the best predictor of success in the subsequent venture. Entrepreneurs who succeeded by investing in a good industry and year (e.g., computers in 1983) are far more likely to succeed in their subsequent ventures than those who succeeded by doing better than other firms founded in the same industry and year (e.g., succeeding in computers in 1985). More importantly, entrepreneurs who invest in a good industry-year are more likely to invest in a good industry-year in their next ventures, even after controlling for differences in overall success rates across industries. Thus, it appears that market timing ability is an attribute of entrepreneurs. We do not find evidence that previously successful

entrepreneurs are able to start companies in a good industry-year because they are wealthier.

Entrepreneurs who exhibit market timing skill in their first ventures also appear to outperform their industry peers in their subsequent ventures. This could be explained by the correlation of market timing skill with managerial skill – those who know when and where to invest could also be good at managing the ventures they start. However, we find that entrepreneurs who outperform their industry peers in their first venture are not more likely to choose good industry-years in which to invest in their later ventures. Thus, it seems unlikely that there is a simple correlation between the two skills, though it is certainly possible that entrepreneurs with market timing skill have managerial skill, but not vice versa.

Rather, this evidence provides support for the view that some component of performance persistence stems from "success breeding success." In this view, entrepreneurs with a track record of success can more easily attract suppliers of capital, labor, goods and services if suppliers believe there is performance persistence. A knack for choosing the right industry-year in which to start a company generates additional subsequent excess performance if, as a result, the entrepreneur can line up higher quality resources for his next venture. For example, high-quality engineers or scientists may be more interested in joining a company started by an entrepreneur who previously started a company in a good industry and year if they believe (justifiably given the evidence) that this track record increases the likelihood of success. Likewise, a potential customer of a new hardware or software firm concerned with the long-run viability of the start-up will be more willing to buy if the entrepreneur has a track record of choosing the right time

and place to start a company. Thus, market timing skill in one venture can generate excess performance (which looks like managerial skill) in the next. Note that this is not necessarily evidence of the extreme version of "success breeding success" in which the *misperception* that skill matters generates performance persistence. Instead, we are suggesting that if successful entrepreneurs are somewhat better than unsuccessful ones, the differential will be amplified by their ability to attract more and better resources.

There is another piece of evidence that supports our finding of performance persistence. As has been shown by Sorensen (2007), Kaplan and Schoar (2005), Gompers, Kovner, Lerner and Scharfstein (2008), and Hochberg, Ljungqvist, and Lu (2007), companies that are funded by more experienced (top-tier) venture capital firms are more likely to succeed. This could be because top-tier venture capital firms are better able to identify high-quality companies and entrepreneurs, or because they add more value to the firms they fund (e.g., by helping new ventures attract critical resources or by helping them set business strategy). However, we find a performance differential only when venture capital firms invest in companies started by first-time entrepreneurs or those who previously failed. If a company is started by an entrepreneur with a track record of success, then the company is no more likely to succeed if it is funded by a top-tier venture capital firm than one in the lower tier. This finding is consistent both with skill-based and perception-based performance persistence. If successful entrepreneurs are better, then top-tier venture capital firms have no advantage identifying them (because success is public information) and they add little value. And, if successful entrepreneurs have an easier time attracting high-quality resources and customers

because of perception-based performance persistence, then top-tier venture capital firms add little value.

To our knowledge, there is little in the academic literature on performance persistence in entrepreneurship. The closest line of work documents the importance of experience for entrepreneurial success. For example, Bhide (2000) finds that a substantial fraction of the Inc. 500 got their idea for their new company while working at their prior employer. And, Chatterji (forthcoming) finds that within the medical device industry, former employees of prominent companies tend to perform better across a number of metrics, including investment valuation, time to product approval, and time to first funding. Finally, Bengtsson (2007) shows that it relatively rare for serial entrepreneurs to receive funding from the same venture capital firm across multiple ventures. This is consistent with the view that success is a public measure of quality and that venture capital relationships play little role in enhancing performance.

2. Data

The core data for the analysis come from Dow Jones' *Venture Source* (previously called *Venture One*), described in more detail in Gompers, Lerner, and Scharfstein (2005). *Venture Source*, established in 1987, collects data on firms that have obtained venture capital financing. Firms that have received early-stage financing exclusively from individual investors, federally chartered Small Business Investment Companies, and corporate development groups are not included in the database. The companies are initially identified from a wide variety of sources, including trade publications, company Web pages, and telephone contacts with venture investors. *Venture Source* then collects information about the businesses through interviews with venture capitalists and entrepreneurs. The data

include the identity of the key founders (the crucial information used here), as well as the industry, strategy, employment, financial history, and revenues of the company. Data on the firms are updated and validated through monthly contacts with investors and companies.

Our analysis focuses on data covering investments from 1975 to 2003, dropping information prior to 1975 due to data quality concerns.[1] In keeping with industry estimates of a maturation period of three to five years for venture capital financed companies, we drop companies receiving their first venture capital investment after 2003 so that the outcome data can be meaningfully interpreted.

For the purposes of this analysis, we examine the founders (henceforth referred to as "entrepreneurs") that joined firms listed in the *Venture Source* database during the period from 1986 to 2003. Typically, the database reports the previous affiliation and title (at the previous employer) of these entrepreneurs, as well as the date they joined the firm. In some cases, however, *Venture Source* did not report this information. In these cases, we attempt to find this information by examining contemporaneous news stories in LEXIS-NEXIS, securities filings, and web sites of surviving firms. We believe this data collection procedure may introduce a bias in favor of having more information on successful firms, but it is not apparent to us that it affects our analysis.

We identify serial entrepreneurs through their inclusion as founders in more than one company in our data set. As a result, we may fail to identify serial entrepreneurs who had previously started companies that were not venture capital financed. Thus, our study is only about serial entrepreneurship in venture capital-financed firms, not about serial

[1]Gompers and Lerner (2004) discuss the coverage and selection issues in Venture Economics and Venture Source data prior to 1975.

entrepreneurship in general. To the extent that prior experience in non-venture-backed companies is important, we will be understating the effect of entrepreneurial experience.

Table 1 reports the number and fraction of serial entrepreneurs in our sample in each year. Several patterns are worth highlighting. First, the number of entrepreneurs in the sample increased slowly from 1984 through 1994. Afterwards, as the Internet and technology boom took off in the mid-1990s, the number of entrepreneurs grew very rapidly. Second, with the general growth of the industry through this period, serial entrepreneurs accounted for an increasing fraction of the sample, growing from about 7% in 1986 to a peak of 13.6% in 1994. There was some decrease in the fraction of serial entrepreneurs after 1994, probably because of the influx of first-time entrepreneurs as part of the Internet boom. The absolute number of serial entrepreneurs actually peaked in 1999.

Table 2 documents the distribution of serial entrepreneurs across industries based on the nine industry groupings used in Gompers, Kovner, Lerner, and Scharfstein (2006). The data show a clear concentration of entrepreneurs in the three sectors that are most closely associated with the venture capital industry: Internet and computers; communications and electronics; and biotechnology and healthcare. These are also the three industries with the highest representation of serial entrepreneurs. The other industries, such as financial services and consumer, are smaller and have a lower percentage of serial entrepreneurs.

Table 3 lists the 40 most active venture capital firms in our sample and ranks them according to both the number of serial entrepreneurs they have funded and the fraction of serial entrepreneurs in their portfolios. Given that many successful venture capital firms have an explicit strategy of funding serial entrepreneurs, it is not surprising

that these firms have higher rates of serial entrepreneurship than the sample average. This tabulation suggests that the biggest and most experienced venture capital firms are more successful in recruiting serial entrepreneurs. Nevertheless, there does appear to be quite a bit of heterogeneity among these firms in their funding of serial entrepreneurs. Some of the variation may stem from the industry composition of their portfolios, the length of time that the venture capital firms have been active investors, and the importance they place on funding serial entrepreneurs. In any case, the reliance on serial entrepreneurs of the largest, most experienced, and most successful venture capital firms indicates that we will need to control for venture capital firm characteristics in trying to identify an independent effect of serial entrepreneurship.

Table 4 provides summary statistics for the data we use in our regression analysis. We present data for (1) all entrepreneurs in their first ventures; (2) entrepreneurs who have started only one venture; (3) serial entrepreneurs in their first venture; and (4) serial entrepreneurs in their later ventures.

The first variable we look at is the success rate within these subgroups of entrepreneurs. We define "success" as going public or filing to go public by December 2007. The findings are similar if we define success to also include firms that were acquired or merged. The overall success rate on first-time ventures is 25.3%. Not surprisingly, serial entrepreneurs have an above-average success rate of 36.9% in their first ventures. It is more interesting that in their subsequent ventures they have a significantly higher success rate (29.0%) than do first-time entrepreneurs (25.3%).

Serial entrepreneurs have higher success rates, even though on average they receive venture capital funding at an earlier stage in their company's development. While 45% of

first-time ventures receive initial venture capital funding at an early stage (meaning they are classified as "startup," "developing product," or "beta testing," and not yet "profitable" or "shipping product"), close to 60% of entrepreneurs receive initial venture capital funding at an early stage when it is their second or later venture. The later ventures of serial entrepreneurs also receive first-round funding when their firms are younger–21 months as compared to 37 months for first-time entrepreneurs. This earlier funding stage is also reflected in lower initial pre-money valuations for serial entrepreneurs: $12.3 million as compared to $16.0 million for first-time entrepreneurs.

Controlling for year, serial entrepreneurs appear to be funded by more experienced venture capital firms, both in their first and subsequent ventures. The last row of Table 4 reports the ratio of the number of prior investments made by the venture capital firm to the average number of prior investments made by other venture capital firms in the year of the investment. This ratio is consistently greater than one because more experienced (and likely larger) venture capital firms do more deals. The table indicates that venture capital firms that invest in serial entrepreneurs, whether in their first or subsequent ventures, have nearly three times the average experience of the average firm investing in the same year. This is about 14% greater than the year-adjusted experience of venture capital firms that invest in one-time-only entrepreneurs.[2] Given the evidence that more experienced venture capital firms have higher success rates (e.g., Gompers, Kovner, Lerner and Scharfstein, 2008), it will be important for us to control for venture capital experience in our regression analysis, as well as control for other factors such as company location, that has also been linked to outcomes.

[2]Note that venture capital firms that invest in the first ventures of serial entrepreneurs have done fewer deals on an absolute basis. This is because these first deals tend to be earlier in the sample period.

3. Findings

A. Success

In this section we take a multivariate approach to exploring performance persistence among serial entrepreneurs. In the first set of regressions, the unit of analysis is the entrepreneur at the time that the database first records the firm's venture capital funding. Our basic approach is to estimate logistic regressions where the outcome is whether the firm "succeeds," i.e., goes public or registers to go public by December 2007. Our results are qualitatively similar if we redefine success to include an acquisition in which the purchase price exceeds $50 million as a successful outcome.

A main variable of interest in the initial regressions is a dummy variable, *LATER VENTURE*, which takes the value one if the entrepreneur had previously been a founder of a venture capital backed company. We are also interested in whether the entrepreneur had *succeeded* in his prior venture, and thus construct a dummy variable, *PRIOR SUCCESS*, to take account of this possibility.

There are a number of controls that must be included in the regression as well. As noted above, we control for a venture capital firm's experience. The simplest measure of experience is the number of prior companies in which the venture capital firm invested. We take a log transformation of this number to reflect the idea that an additional investment made by a firm that has done relatively few deals is more meaningful than an additional investment by a firm that has done many. However, because of the growth and maturation of the venture capital industry, there is a time trend in this measure of experience. This is not necessarily a problem; investors in the latter

part of the sample do have more experience. Nevertheless, we use a more conservative measure of experience, which adjusts for the average level of experience of other venture capital firms in the relevant year. Thus, our measure of experience for a venture capital investor is the log of one plus the number of prior companies in which the venture capital firm has invested minus the log of one plus the average number of prior investments undertaken by venture capital firms in the year of the investment. Because there are often multiple venture capital firms investing in a firm in a given round, we must decide how to deal with their different levels of experience. We choose to take the experience of most experienced venture capital firm with representation on the board of directors in the first venture financing round. We label this variable *VC EXPERIENCE*.[3]

The regressions also include dummy variables for the round of the investment. Although we include each company only once (when the company shows up in the database for the first time), about 26% of the observations begin with rounds later than the first round. (In these instances, the firm raised an initial financing round from another investor, such as a wealthy individual, typically referred to as an angel investor.) All of the results are robust to including only companies where the first observation in the database is the first investment round. We also include dummy variables for the company's stage of development and logarithm of company age in months. Because success has been tied to location, we include a dummy variable for whether the firm was headquartered in California and one for whether it was headquartered in Massachusetts. We also include year and industry fixed effects. We report analysis based on fixed

[3]We have replicated the analysis using the average experience of investors in the earliest round and employing an entrepreneur-company-VC firm level analysis where each investor from the earliest round was a separate observation. In both cases, the results were qualitatively similar. We do not use the experience of venture capitalists that do not join the firm's board, since it is standard practice for venture investors with significant equity stakes or involvement with the firm to join the board.

effects for nine industry classifications. All of the results are robust to assigning firms to one of 18 industries instead. Finally, because there is often more than one entrepreneur per company, there will be multiple observations per company. Thus, robust standard errors of the coefficient estimates are calculated after clustering by company. In later regressions, the unit of analysis will be the company.

The first column of Table 5 reports one of the central findings of the paper. The coefficient of *LATER VENTURE*, which is statistically significant, is 0.041, indicating that entrepreneurs in second or later ventures have a 4.1% higher probability of succeeding than first-time entrepreneurs. At the means of the other variables, entrepreneurs in their second or later ventures have a predicted success rate of 25.0%, while first-time entrepreneurs have a predicted success rate of 20.9%.

This finding is consistent with the existence of learning-by-doing in entrepreneurship. In this view, the experience of starting a new venture – successful or not – confers on entrepreneurs some benefits (skills, contacts, ideas) that are useful in subsequent ventures.

To determine whether there is a pure learning-by-doing effect, in the second column of Table 5 we add the dummy variable, *PRIOR SUCCESS*, which equals 1 if the prior venture of the serial entrepreneur was successful. The estimated coefficient of this variable is positive and statistically significant. Including it also lowers the coefficient of the *LATER VENTURE* dummy so that it is no longer statistically significant. The predicted success rate of entrepreneurs with a track record of success is 30.6%, compared to only 22.1% for serial entrepreneurs who failed in their prior venture, and 20.9% for first-time entrepreneurs. This finding indicates that it is not experience *per se* that

improves the odds of success for serial entrepreneurs. Instead, it suggests the potential importance of entrepreneurial skill in determining performance.

The unit of analysis for the first two columns of Table 5 is at the entrepreneur-company level. The third column of Table 5 reports the results of a regression in which the unit of analysis is the company, not the entrepreneur-company. The key variables are 1) a dummy for whether *any* of the founders is in their second or later ventures and 2) a dummy for whether *any* of the founders was successful in a prior venture. Here too a track record of prior success has a bigger effect on future success than does prior experience. Companies with a previously successful entrepreneur have a predicted success rate of 30.9%, whereas those with entrepreneurs who failed in prior ventures have an 21.2% success rate, and companies with first-time entrepreneurs have a 17.1% chance of success. There is a modest (3.8%), statistically significant effect of entrepreneurial experience on performance and a large (8.1%), statistically significant effect of prior success on performance. The presence of at least one successful entrepreneur on the founding team increased the likelihood of success considerably.

The regressions also indicate that venture capital firm experience is positively related to success. Using estimates from the third column of Table 5, at the 75th percentile of *VC EXPERIENCE* and at the means of all the other variables, the predicted success rate is 22.9%, while at the 25th percentile, the predicted success rate is only 16.4%. There are a number of reasons why more experienced venture capital firms may make more successful investments.

VC EXPERIENCE as undoubtedly an imperfect proxy for the quality of a venture capital firm. If successful entrepreneurs are more likely to get funded by better venture

capital firms, we could be getting a positive coefficient of *PRIOR SUCCESS* because it is a proxy for the unobservable components of venture capital firm quality that are not captured by *VC EXPERIENCE*. Thus, to control for unobservable characteristics, we estimate the model with venture capital firm fixed effects. This enables us to estimate how well a given venture capital firm does on its investments in serial entrepreneurs relative to its other investments in first-time entrepreneurs. Results in the fourth and fifth columns of Table 5 indicate that with venture capital firm fixed effects, the differential between first-time entrepreneurs and successful serial entrepreneurs is even larger**.** The fifth column, which estimates the effects at the company level, generates a predicted success rate for first-time entrepreneurs of 17.7%. The predicted success rate for failed serial entrepreneurs in later ventures is 19.8%, and it is 29.6% for entrepreneurs with successful track records.

Financing from experienced venture capital firms has a large effect on the probability that an entrepreneur succeeds for several reasons: because these firms are better able to screen for high-quality entrepreneurs; because they are better monitors of entrepreneurs; or because they simply have access to the best deals. But, if an entrepreneur already has a demonstrable track record of success, does a more experienced venture capital firm still enhance the probability of a successful outcome? To answer this question, we add to the basic specification in column 2 and 3 of Table 5 an interaction between *VC EXPERIENCE* and *PRIOR SUCCESS,* as well an interaction between *VC EXPERIENCE* and *LATER VENTURE*.

The results are reported in columns 6 and 7 of the table. The coefficient of *VC EXPERIENCE×PRIOR SUCCESS* is negative and statistically significant, though

somewhat more so in column 6. This indicates that venture capital firm experience has a less positive effect on the performance of entrepreneurs with successful track records. Indeed, using estimates from column 7, the predicted success rate for previously successful entrepreneurs is 32.4% when funded by more experienced venture capital firms (at the 75th percentile of *VC EXPERIENCE*) and 31.9% when funded by less experienced venture capital firms (at the 25th percentile of *VC EXPERIENCE*). Essentially, venture capital firm experience has a minimal effect on the performance of entrepreneurs with good track records. Where venture capital firm experience does matter is in the performance of first-time entrepreneurs and serial entrepreneurs with histories of failure. First-time entrepreneurs have a 20.9% chance of succeeding when funded by more experienced venture capital firms and a 14.2% chance of succeeding when funded by a less experienced venture capital firm. Likewise, failed entrepreneurs who are funded by more experienced venture capital firms have a 25.9% chance of succeeding as compared to a 17.7% chance of succeeding when they are funded by less experienced venture capital firms.

These findings provide support for the view that there is performance persistence, be it from actual entrepreneurial skill or the perception of entrepreneurial skill. Under the skill-based explanation, when an entrepreneur has a proven track record of success – a publicly observable measure of quality – experienced venture capital firms are no better than others at determining whether he will succeed. It is only when there are less clear measures of quality – an entrepreneur is starting a company for the first time, or an entrepreneur has actually failed in his prior venture – that more experienced venture capital firms have an advantage in identifying entrepreneurs who will succeed.

In addition, previously successful entrepreneurs – who presumably need less monitoring and value-added services if they are more skilled – do not benefit as much from this sort of venture capital firm monitoring, expertise and mitigation of the coordination problem for new enterprises. Under the perception-based explanation, successful entrepreneurs will have an easier time attracting critical resources and therefore do not need top-tier venture capitalists to aid in this process.

B. Identifying Skill

Given the observed performance persistence, we now try to identify whether there are specific entrepreneurial skills that could give rise to it. One potential skill is investing in the right industry at the right time, which we refer to as "market timing skill." For example, 52% of all computer start-ups founded in 1983 eventually went public, while only 18% of those founded in 1985 later went public. Spotting the opportunity in 1983 is much more valuable than entering the industry in 1985. We refer to the ability to invest in the right industry at the right time as "market timing" skill. To estimate the market timing component of success in a serial entrepreneur's first venture, we first calculate the success rate of non-serial entrepreneurs for each industry-year (e.g., a success rate of 52% in the computer industry in 1983). We exclude the first ventures of serial entrepreneurs so as to prevent any "hard-wiring" of a relationship. We then regress the success of serial entrepreneurs in their first ventures on the industry-year success rate, as well as a variety of company characteristics. The predicted value from this regression gives us the market timing component, which we call "PREDICTED SUCCESS." As can be seen from the first column of Table 6, the coefficient of the industry-year success rate is indistinguishable from 1.

By way of contrast, the residual of this regression is the component of success that cannot be explained by industry-year success rates. This is our measure of "managerial skill," which we refer to as "RESIDUAL SUCCESS."

The remaining columns of Table 6 all use the success of second or later ventures as the dependent variable. In the first three columns we include PREDICTED SUCCESS (the component associated with timing) as the key explanatory variable. In each case, we find that PREDICTED SUCCESS is positively related to future success. A serial entrepreneur whose first deal was in a 75th percentile industry-year based on industry success rates has an expected success rate of 31.4% in his second venture, while a serial entrepreneur whose first deal was in a 25th percentile industry-year has an expected success rate of 25.0%.

We test the robustness of this finding in the third column of Table 6 by including Industry x Year dummies as opposed to separate industry and year dummies. The coefficient on PREDICTED SUCCESS remains positive and statistically significant. The component of prior success that is related to market timing still explains the serial entrepreneur's outperformance relative to industry year in subsequent ventures. We explore this persistence further in Table 7.

We also find evidence that "managerial skill" skill matters. Specifications 5 through 7 of Table 6 show a positive, significant coefficient on RESIDUAL SUCCESS. While, these coefficients are smaller than the coefficients on PREDICTED SUCCESS, the difference in quartiles is larger. Thus, a serial entrepreneur whose first deal was in the 75th percentile of residual success year has an expected success rate of 34.9% in his second venture, while a serial entrepreneur whose first deal was in the 25th percentile has

an expected success rate of 26.6%, a difference of 8.3%. A significant component of persistence in serial entrepreneur success can be attributed to skill.

It is temping to associate market timing with luck. Isn't being in the right place at the right time the definition of luck? To examine whether this is the case, we look at whether market timing in the first venture predicts market timing in the second venture. If so, it would be hard to associate market timing with luck. If it really was luck, it should not be persistent. Table 7 shows that market timing is, in fact, persistent. The dependent variable in Table 7 is the the industry-year success rate for the current venture. The sample is limited to serial entrepreneurs. In all specifications, predicted success in prior ventures is positively and significantly related to the industry-year success rate of the current venture. By way of contrast, neither "managerial" skill nor VC firm experience appears to be associated with "market timing" skill.

Table 8 considers the determinants of current venture "managerial" skill, with the dependent variable being the residual generated by the regression of the current venture on the industry-year success rate. As expected, past managerial skill (RESIDUAL SUCCESS) predicts current managerial skill. Market timing skill is also positively and significantly associated with managerial skill. This finding might be explained by the correlation of the two skills; however, this explanation is unlikely given that estimated managerial skill in the first venture fails to predict market timing skill in later ventures. We think a more plausible explanation is that entrepreneurs who have shown themselves to have good market timing skill have an easier time attracting high-quality resources. Customers, for example, will be more willing to buy if they believe the firm will be around to service them in the future. Employees will be more likely to sign on if they

think the firm is more likely to succeed. Thus, demonstrated market timing skill in earlier ventures will generate excess performance (which we refer to as managerial skill) in later ventures. In this sense, success breeds success.

C. An Alternative Explanation: Entrepreneurial Wealth

It is possible that successful entrepreneurs are more likely to succeed in their subsequent ventures because they are wealthier than other entrepreneurs. Their greater wealth could allow them to provide some of the funding, thereby reducing the role of the venture capitalist and the potential inefficiencies associated with external financing. The entrepreneur's deep pockets could also help the firm survive during difficult times. Without observing entrepreneurs' wealth directly it is difficult to rule this alternative out, but we do not find much evidence to support this view. First, if successful entrepreneurs have significant wealth, we would expect them to use their own funds initially and to raise venture capital later in the company's life cycle so as to retain a greater ownership stake and control. In fact, previously successful entrepreneurs raise capital for their later ventures at an earlier age and stage. This is evident from the first four columns of Table 9. The first two columns present the results of ordered probit specifications in which the dependent variable is the stage of the company (start-up, development, shipping, etc.) at the initial round of venture capital financing. Both previously successful and previously unsuccessful serial entrepreneurs receive funding when the company is at an earlier stage. There are similar results for the age of the firm at the initial round of venture capital funding. The average company receives its first round of venture capital funding when it is 2.75 years old, but serial entrepreneurs (both successful and unsuccessful) receive funding approximately a year earlier.

Second, entrepreneurial wealth could increase the likelihood that firms survive, as has been shown for sole-proprietorships by Holtz-Eakin, Joulfaian, and Rosen (1994). In this case, firms started by successful entrepreneurs will have higher success rates, but will take longer to succeed on average. There is no evidence of this. The fifth and sixth columns indicate that firms founded by serial entrepreneurs are younger when they go public. The last two columns show the length of time between first funding and IPO is similar for serial entrepreneurs and first-time entrepreneurs.

While it is unlikely that wealth effects could induce the persistence in market timing that we document, wealth effects could, in principle, amplify perception-based performance persistence. If firms backed by successful entrepreneurs do have higher survival rates because of entrepreneurial wealth, suppliers and customers may be more willing to commit resources to the firm. This would mitigate the coordination problem that affects new ventures.

4. Conclusions

This paper documents the existence of performance persistence in entrepreneurship and studies its sources. We find evidence for the role of skill as well as the perception of skill in inducing performance persistence.

We have not addressed a number of interesting and important issues. One such issue is the determinants of serial entrepreneurship. We conjecture that the very best and the very worst entrepreneurs do not become serial entrepreneurs. The very best entrepreneurs are either too wealthy or too involved in their business to start new ones. If this is true, we are likely understating the degree of performance persistence. The very worst entrepreneurs are unlikely to be able to receive venture funding again. Indeed, the

near-equal success rates of first-time entrepreneurs and previously unsuccessful entrepreneurs suggest that there is a screening process that excludes the worst unsuccessful entrepreneurs from receiving funding. This may be why we do not see performance persistence on the negative side, i.e., failed entrepreneurs doing even worse than first-time entrepreneurs. Taking account of the endogeneity of serial entrepreneurship for measuring performance persistence would be worthwhile.

We have also not addressed the issue of how past performance affects the valuation of venture-capital backed startups. We have shown that successful entrepreneurs raise capital earlier, but what are the terms of their financing? Does their track record result in higher valuations and less restrictive covenants? If there are higher valuations for successful serial entrepreneurs, is the higher success rate enough compensation?

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Table 1: Frequency of Serial Entrepreneurs by Year

Year	Serial Entrepreneurs	Total Entrepreneurs	Serial Entrepreneurs as a Percent of Total
1980	0	11	0.0
1981	0	7	0.0
1982	0	11	0.0
1983	0	34	0.0
1984	2	29	6.9
1985	3	42	7.1
1986	9	99	9.1
1987	9	130	6.9
1988	10	209	4.8
1989	14	254	5.5
1990	35	301	11.6
1991	34	337	10.1
1992	53	522	10.2
1993	65	516	12.6
1994	78	574	13.6
1995	129	1,051	12.3
1996	166	1,262	13.2
1997	141	1,205	11.7
1998	164	1,256	13.1
1999	174	1,678	10.4
2000	38	404	9.4

Sample includes one observation per entrepreneur - company pair. Entrepreneur – company pairs are assigned to the year of their initial venture capital financing. 2000 data are through only approximately mid-year.

Table 2: Frequency of Serial Entrepreneurs by Industry

	Serial Entrepreneurs	Total Entrepreneurs	Serial Entrepreneurs as a Percent of Total
Internet and Computers	556	4,489	12.4
Communications and Electronics	157	1,424	11.0
Business and Industrial	2	109	1.8
Consumer	29	576	5.0
Energy	0	19	0.0
Biotechnology and Healthcare	271	1,964	13.8
Financial Services	11	163	6.7
Business Services	68	827	8.2
Other	30	361	8.3

Sample includes one observation per entrepreneur - company pair.

Table 3: Frequency of Serial Entrepreneurs by Venture Capital Firm

Year	Serial Entrepreneurs	Total Entrepreneurs	Serial Entrepreneurs as a Percent of Total	Ranking by: Number	Ranking by: Percent
Kleiner Perkins Caufield & Byers	100	666	15.0	1	9
New Enterprise Associates	80	702	11.4	2	28
Sequoia Capital	69	432	16.0	3	5
U.S. Venture Partners	68	454	15.0	4	10
Mayfield	63	459	13.7	5	19
Accel Partners	61	418	14.6	6	13
Crosspoint Venture Partners	60	407	14.7	7	11
Institutional Venture Partners	56	385	14.5	8	14
Bessemer Venture Partners	49	340	14.4	9	16
Matrix Partners	44	275	16.0	10	4
Menlo Ventures	43	305	14.1	11	17
Sprout Group	42	315	13.3	12	21
Brentwood Associates	40	265	15.1	14	8
Venrock Associates	40	389	10.3	13	31
Mohr Davidow Ventures	38	251	15.1	16	6
Oak Investment Partners	38	462	8.2	15	39
Domain Associates	37	210	17.6	17	1
Benchmark Capital	36	264	13.6	19	20
Greylock Partners	36	374	9.6	18	34
InterWest Partners	35	312	11.2	20	29
Advent International	33	238	13.9	21	18
Foundation Capital	31	188	16.5	24	2
Enterprise Partners Venture Capital	31	215	14.4	23	15
Canaan Partners	31	252	12.3	22	23
Delphi Ventures	30	185	16.2	26	3
Sigma Partners	30	204	14.7	25	12
Charles River Ventures	29	192	15.1	27	7
Norwest Venture Partners	27	231	11.7	28	25
Austin Ventures	25	270	9.3	29	36
Morgan Stanley Venture Partners	24	191	12.6	34	22
Lightspeed Venture Partners	24	202	11.9	33	24
Sutter Hill Ventures	24	207	11.6	32	26
Battery Ventures	24	242	9.9	31	33
Sevin Rosen Funds	24	254	9.4	30	35
JPMorgan Partners	23	225	10.2	36	32
St. Paul Venture Capital	23	277	8.3	35	38
Alta Partners	22	190	11.6	37	27
Morgenthaler	20	183	10.9	38	30
Trinity Ventures	18	214	8.4	39	37
Warburg Pincus	16	195	8.2	40	40

Sample includes one observation per VC firm-portfolio company. The 40 VC firms with the most total deals in the sample are included.

Table 4: Summary Statistics

	All First Ventures	Entrepreneurs with Only One Venture	Serial Entrepreneurs: First Venture		Serial Entrepreneurs: Later Ventures	
Success Rate	0.253	0.243	0.369	***	0.290	***
Pre-Money Valuation (millions of 2000 $)	15.95	15.78	17.75	*	12.30	***
Firm in Startup Stage	0.116	0.118	0.090	**	0.175	***
Firm in Development Stage	0.294	0.294	0.293		0.377	***
Firm in Beta Stage	0.039	0.039	0.037		0.045	
Firm in Shipping Stage	0.469	0.470	0.462		0.362	***
Firm in Profitable Stage	0.073	0.070	0.101	**	0.036	***
Firm in Re-Start Stage	0.009	0.009	0.016		0.006	
California-Based Company	0.430	0.417	0.578	***	0.591	***
Massachusetts-Based Company	0.119	0.119	0.122		0.119	
Age of Firm (in Months)	36.64	36.30	40.54	**	20.60	***
Previous Deals by VC Firm	51.35	51.76	46.70	***	58.86	***
Previous Deals by VC Firm Relative to Year Average	2.896	2.887	2.989		3.290	***
Observations	8,808	8,095	713		1,124	

Table 5: Venture Success Rates

	(1) Probit		(2) Probit		(3) Probit		(4) Probit		(5) Probit		(6) Probit		(7) Probit	
LATER VENTURE	0.0411		0.0126				0.0017				0.0069			
	(2.92)	***	(0.73)				(0.09)				(0.34)			
PRIOR SUCCESS			0.0830				0.0992				0.1252			
			(2.93)	***			(3.04)	***			(3.68)	***		
Any Entrepreneur In LATER VENTURE					0.0384				0.0222				0.0362	
					(2.21)	**			(1.01)				(1.65)	*
Any Entrepreneur Has PRIOR SUCCESS					0.0808				0.0939				0.1198	
					(3.12)	***			(2.90)	***			(3.66)	***
VC FIRM EXPERIENCE	0.0381		0.0379		0.0357						0.0391		0.0399	
	(4.51)	***	(4.49)	***	(5.82)	***					(4.56)	***	(5.52)	***
VC FIRM EXPERIENCE X LATER VENTURE											0.0079			
											(0.51)			
VC FIRM EXPERIENCE X PRIOR SUCCESS											-0.0453			
											(2.02)	**		
VC FIRM EXPERIENCE X Any Entrepreneur In Later Venture													0.0027	
													(0.16)	
VC FIRM EXPERIENCE X Any Entrepreneur Has PRIOR SUCCESS													-0.0404	
													(1.87)	*
Controls:														
Company Age	yes		yes		yes		yes		yes		yes		yes	
Company Location	yes		yes		yes		yes		yes		yes		yes	
Company Stage	yes		yes		yes		yes		yes		yes		yes	
Round	yes		yes		yes		yes		yes		yes		yes	
Year	yes		yes		yes		yes		yes		yes		yes	
Industry	yes		yes		yes		yes		yes		yes		yes	
VC Firm Fixed Effects	no		no		no		yes		yes		no		no	
Log-likelihood	-4872.2		-4867.7		-1635.5		-9568.9		-2805.8		-4865.5		-1632.9	
χ^2-Statistic	373.1		376.9		536.7		1008.7		1034.9		379.4		535.7	
p-Value	0.000		0.000		0.000		0.000		0.000		0.000		0.000	
Observations	9,876		9,876		3,831		19,617		6,180		9,876		3,831	

The sample consists of 9,932 ventures by 8,808 entrepreneurs covering the years 1975 to 2000. The dependent variable is *Success*, an indicator variable that takes on the value of one if the portfolio company went public and zero otherwise. *LATER VENTURE* is an indicator variable that takes on the value of one if the entrepreneur had started a previous venture-backed company and zero otherwise. *PRIOR SUCCESS* is an indicator variable that takes on the value of one if the entrepreneur had started a previous venture-backed company that went public or filed to go public by December 2003 and zero otherwise. *Any Entrepreneur in Later Venture* is an indicator variable that takes the value of one if any entrepreneur within the company had started a previous venture-backed company and zero otherwise. *Any Entrepreneur with Prior Success* is an indicator variable that takes the value of one if any entrepreneur within the company started a previous venture-backed company that went public or filed to go public by December 2003 and zero otherwise. *VC FIRM EXPERIENCE* is the difference between the log of the number of investments made by venture capital organization f prior to year t and the average in year t of the number of investments made by all organizations prior to year t. The sample analyzed in columns 1, 2, and 6 is at the entrepreneur-company level, the sample analyzed in columns 3 and 7 is at the company level, the sample analyzed in column 4 is at the entrepreneur-company-VC firm level, and the sample analyzed in column 5 is at the company-VC firm level.

Standard errors are clustered at portfolio company level. Robust t-statistics are in parentheses below coefficient estimates.

***, **, * indicate statistical significance at the 1%, 5% and 10% level, respectively.

Table 6: Venture Success Rates: Two-Stage Specifications

	(1) OLS		(2) OLS		(3) OLS		(4) OLS		(5) OLS		(6) OLS		(7) OLS	
Industry-Year Success Rates	0.9408													
	[10.18]	***												
Predicted Success			0.3437		0.2565		0.442		0.339		0.2508		0.4436	
			[3.48]	***	[2.29]	**	[8.13]	***	[3.52]	***	[2.27]	**	[8.41]	***
Residual Success									0.0892		0.0883		0.098	
									[2.17]	**	[2.58]	***	[2.24]	**
VC FIRM EXPERIENCE			0.036		0.045		0.0313		0.0352		0.0437		0.0298	
			[3.54]	***	[4.32]	***	[2.40]	**	[3.43]	***	[4.01]	***	[2.36]	**
Controls:														
Company Age	yes		yes		yes		yes		yes		yes		yes	
Company Location	yes		yes		yes		yes		yes		yes		yes	
Company Stage	yes		yes		yes		yes		yes		yes		yes	
Round	no		yes		yes		yes		yes		yes		yes	
Industry	no		yes		yes		no		yes		yes		no	
Year	no		yes		yes		no		yes		yes		no	
Industry*Year	no		no		yes		no		no		yes		no	
N	850		850		850		850		850		850		850	
R-squared	0.08		0.16		0.27		0.06		0.17		0.28		0.07	

The sample consists of 1,293 second or later ventures of 1,044 entrepreneurs covering the years 1975 to 2000. In column 1, a first-stage ordinary least squares regression is run with Success in Prior Venture, an indicator variable that takes on the value of one if the previous portfolio company of the entrepreneur went public and zero otherwise, as the dependent variable. Columns 2-7 run a second stage ordinary least squares regression with Success in Current Venture as the dependent variable. Predicted Success is the predicted value from the first-stage regression and Residual Success is the residual from the first stage. VC Firm Experience is the difference between the log of the average number of investments made by venture capital organization f prior to year t for each investment in the fund and the average in year t of the average number of investments made by all organizations prior to year t. Controls are dummy variables.

Standard errors are clustered at year level. Robust t-statistics are in parentheses below coefficient estimates.

***, **, * indicate statistical significance at the 1%, 5% and 10% level, respectively.

Table 7: Persistence of Market Timing

	(1) OLS		(2) OLS		(3) OLS		(4) OLS	
Predicted Success	0.1676		0.1115		0.0588		0.0442	
	[3.54]	***	[2.36]	**	[2.56]	**	[2.21]	**
Residual Success	0.0062		0.0078		0.0027		0.0009	
	[0.60]		[0.79]		[0.78]		[0.28]	
VC FIRM EXPERIENCE (Prior Venture)	-0.012		-0.0123		0.0004		0.0004	
	[2.14]	**	[2.06]	**	[0.10]		[0.12]	
Industry controls	no		yes		no		yes	
Year controls	no		no		yes		yes	
Observations	850		850		850		850	
R-squared	0.03		0.08		0.79		0.81	

The sample consists of 1,293 second or later ventures of 1,044 entrepreneurs covering the years 1975 to 2000. The dependent variable is the industry-year success rate for the current venture. Predicted Success is the predicted value from the first-stage regression in the first column of Table 6 and Residual Success is the residual from the first stage. VC FIRM EXPERIENCE (Prior Venture) is the difference between the log of the average number of investments made by venture capital organization f prior to year t for each investment in the fund and the average in year t of the average number of investments made by all organizations prior to year t for the entrepreneur's prior venture.

Standard errors are clustered at year level. Robust t-statistics are in parentheses below coefficient estimates.

***, **, * indicate statistical significance at the 1%, 5% and 10% level, respectively.

Table 8: Persistence of Managerial Skill

	(1) OLS		(2) OLS		(3) OLS		(4) OLS	
Predicted Success	0.2244		0.3015		0.2		0.2718	
	[3.41]	***	[3.25]	***	[2.76]	***	[2.72]	***
Residual Success	0.0864		0.0821		0.0867		0.0829	
	[1.99]	**	[1.97]	**	[1.95]	*	[1.96]	**
VC FIRM EXPERIENCE	0.0123		0.0136		0.0081		0.01	
(Prior Venture)	[0.74]		[0.82]		[0.53]		[0.65]	
Industry controls	no		yes		no		yes	
Year controls	no		no		yes		yes	
Observations	850		850		850		850	
R-squared	0.0149		0.0326		0.0334		0.0498	

The sample consists of 1,293 second or later ventures of 1,044 entrepreneurs covering the years 1975 to 2000. The dependent variable is the difference between actual success and industry-year success rate for the current venture. Predicted Success is the predicted value from the first-stage regression in the first column of Table 6 and Residual Success is the residual from the first stage. VC FIRM EXPERIENCE (Prior Venture) is the difference between the log of the average number of investments made by venture capital organization f prior to year t for each investment in the fund and the average in year t of the average number of investments made by all organizations prior to year t for the entrepreneur's prior venture.

Standard errors are clustered at year level. Robust t-statistics are in parentheses below coefficient estimates.

***, **, * indicate statistical significance at the 1%, 5% and 10% level, respectively.

Table 9: Serial Entrepreneurship and Company Stage, Age and Time to IPO

	Stage of company at initial VC investment		Age of company at initial VC investment		Age of company at initial public offering		Years from initial VC investment to IPO	
	ORDERED PROBIT		OLS	OLS	OLS	OLS	OLS	OLS
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
LATER VENTURE	-0.2074	-0.166	-1.0292	-1.0046	-1.3891	-1.2713	-0.1029	-0.1575
	[5.98] ***	[3.84] ***	[10.84] ***	[9.55] ***	[6.73] ***	[5.23] ***	[1.13]	[1.29]
PRIOR SUCCESS		-0.1198		-0.0708		-0.2733		0.1244
		[1.83] *		[0.47]		[1.03]		[0.76]
VC FIRM EXPERIENCE	-0.0144	-0.0143	-0.1732	-0.1731	-0.0312	-0.032	-0.0981	-0.0976
	[0.85]	[0.84]	[2.71] ***	[2.71] ***	[0.26]	[0.27]	[1.72] *	[1.71] *
Controls for:								
Company Age at Founding	no	no	no	no	no	no	yes	yes
Company Location	yes	yes	yes	yes	yes	yes	yes	yes
Year	yes	yes	yes	yes	yes	yes	yes	yes
Industry	yes	yes	yes	yes	yes	yes	yes	yes
R-squared	0.0675	0.0676	0.0683	0.0683	0.1795	0.1797	0.6230	0.6231
Observations	9,841	9,841	9,841	9,841	2,475	2,475	2,415	2,415

The sample consists of 9,932 ventures by 8,808 entrepreneurs covering the years 1975 to 2000. The dependent variable *Stage of company at initial VC investment* is a categorical variable that takes on the following values depending on the stage of initial VC investment: 1) startup, 2) development, 3) beta, 4) shipment, 5) profit, and 6) restart. The dependent variables *Age of company at initial VC investment* and *Age of company at initial public offering* measure the age of the company at each milestone in years. *LATER VENTURE* is an indicator variable that takes on the value of one if the entrepreneur had started a previous venture-backed company and zero otherwise. *PRIOR SUCCESS* is an indicator variable that takes on the value of one if the entrepreneur had started a previous venture-backed company that went public or filed to go public by December 2003 and zero otherwise. *VC FIRM EXPERIENCE* is the difference between the log of the number of investments made by venture capital organization f prior to year t and the average in year t of the number of investments made by all organizations prior to year t. The sample analyzed in all columns is at the entrepreneur-company level.

Standard errors are clustered at portfolio company level. Robust t-statistics are in parentheses below coefficient estimates. R-squared values for ordered probits are pseudo r-squared values.

***, **, * indicate statistical significance at the 1%, 5% and 10% level, respectively.