Performance persistence in entrepreneurship ☆

Paul Gompers [a,b], Anna Kovner [c], Josh Lerner [a], David Scharfstein [a,*]

[a] Harvard Business School, Harvard University, Baker Library 239, Soldiers Field, Boston, MA 02163, USA
[b] NBER, National Bureau of Economic Research, Cambridge, MA, USA
[c] Federal Reserve Bank of New York, New York, NY 10045, USA

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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 a 21% chance of succeeding and entrepreneurs who previously failed have a 22% 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 start-ups 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 start-ups founded at the same time and in the same industry. This factor may capture managerial skill as well as the quality of the business idea.[1] We measure this factor 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.

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[1] Kaplan, Sensoy, and Stromberg (2009) find that the business idea is more stable than the human capital of venture-capital-backed businesses.

The closest line of work shows 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 (2009) 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 is 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 a minor 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.

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 2000. The Venture Source database explicitly identifies which of the entrepreneurs are founders of the firm, based on frequent contacts with management. Due to the slow pace of exits in the 2000s, we end the sample in 2000 in order to ensure that we have adequate time to evaluate success using outcome data available through December 2007. This results in a sample of 8,753 entrepreneurs in 3796 companies. 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 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 1985 to a peak of 13.1% 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.

Panel A of Table 2 shows the distribution of serial entrepreneurs across industries based on the nine industry groupings used in Gompers, Kovner and Lerner (2009). 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

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
1982	0	11	0.0
1983	0	34	0.0
1984	0	27	0.0
1985	3	42	7.1
1986	9	99	9.1
1987	9	130	6.9
1988	9	206	4.4
1989	12	252	4.8
1990	33	287	11.5
1991	29	322	9.0
1992	49	515	9.5
1993	59	503	11.7
1994	75	571	13.1
1995	119	1,037	11.5
1996	152	1,248	12.2
1997	132	1,186	11.1
1998	154	1,246	12.4
1999	157	1,661	9.5
2000	36	402	9.0

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.

Panel A: *Frequency of serial entrepreneurs by industry* (*includes all ventures*)

	Serial entrepreneurs	Total entrepreneurs	Serial entrepreneurs as a percent of total
Internet and computers	507	4,420	11.5%
Communications and electronics	147	1,403	10.5%
Business and industrial	2	109	1.8%
Consumer	24	571	4.2%
Energy	0	19	0.0%
Biotechnology and healthcare	256	1,929	13.3%
Financial services	10	162	6.2%
Business services	62	817	7.6%
Other	29	360	8.1%

Sample includes one observation per entrepreneur-company pair.
This table provides summary statistics of the distribution of serial entrepreneurs by industry.

Panel B: *Industry distribution of entrepreneurs' initial and later ventures*

	Industry of initial venture									Total later ventures	Percent of later ventures
	Internet and computers	Comm. and electronics	Business and industrial	Consumer	Energy	Biotech and healthcare	Financial services	Business services	Other		
Industry of later venture											
Internet and computers	66.48%	51.27%	75.00%	26.32%	0.00%	12.98%	16.67%	50.00%	48.15%	507	48.89%
Communications and electronics	12.05%	37.34%	12.50%	0.00%	100.00%	3.82%	33.33%	31.25%	11.11%	147%	14.18%
Business and industrial	0.19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.70	2	0.19%
Consumer	2.26	0.63	0.00	36.84	0.00	1.15	0.00	0.00	3.70	24	2.31%
Energy	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00%
Biotech and healthcare	6.21	6.96	6.25	15.79	0.00	77.48	50.00	0.00	7.41	256	24.69%
Financial services	1.32	0.00	0.00	0.00	0.00	0.38	0.00	12.50	0.00	10	0.96%
Business services	9.23	1.90	6.25	15.79	0.00	1.15	0.00	6.25	7.41	62	5.98%
Other	2.26	1.90	0.00	5.26	0.00	3.05	0.00	0.00	18.52	29	2.80%
Total initial ventures	531	158	16	19	2	262	6	16	27	1,037	
Percent of serial entrepreneurs' initial ventures in industry	51.21%	15.24%	1.54%	1.83%	0.19%	25.27%	0.58%	1.54%	2.60%		

Cells report column percentages.
This table provides summary statistics of the distribution of serial entrepreneurs by initial and later industry.

services and consumer, are smaller and have a lower percentage of serial entrepreneurs. Panel B of Table 2 shows the industry distribution of entrepreneurs' initial and later ventures. The preponderance of observations is along the diagonal; on average more than half of entrepreneurs' later ventures are in the same venture as their initial venture. If entrepreneurs switch industries, they gravitate to Internet and computers.

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.

Panel A of Table 4 provides summary statistics for the data we use in our regression analysis. We present data for (1) all entrepreneurs in all ventures; (2) all entrepreneurs in their first ventures; (3) entrepreneurs who have started only one venture; (4) serial entrepreneurs in their first venture; and (5) serial

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	Percent
Kleiner Perkins Caufield & Byers	80	525	15.2	1	12
U.S. Venture Partners	56	341	16.4	2	6
Sequoia Capital	55	314	17.5	3	4
Accel Partners	54	334	16.2	4	7
New Enterprise Associates	52	497	10.5	5	29
Institutional Venture Partners	49	258	19.0	6	2
Mayfield	47	344	13.7	7	18
Sprout Group	45	281	16.0	8	8
Crosspoint Venture Partners	41	282	14.5	9	16
Matrix Partners	37	203	18.2	10	3
Menlo Ventures	34	231	14.7	11	14
Venrock Associates	32	264	12.1	12	20
Mohr Davidow Ventures	32	227	14.1	13	17
Oak Investment Partners	27	375	7.2	14	38
Bessemer Venture Partners	27	231	11.7	15	22
Enterprise Partners Venture Capital	27	173	15.6	16	10
Delphi Ventures	27	140	19.3	17	1
Austin Ventures	26	220	11.8	18	21
Battery Ventures	24	237	10.1	19	31
Greylock Partners	24	217	11.1	20	27
Sevin Rosen Funds	23	204	11.3	21	25
Advent International	23	181	12.7	22	19
Domain Associates	23	135	17.0	23	5
InterWest Partners	22	229	9.6	24	33
Norwest Venture Partners	22	151	14.6	25	15
Atlas Venture	21	136	15.4	26	11
Benchmark Capital	20	127	15.7	27	9
St. Paul Venture Capital	19	222	8.6	28	35
Morgan Stanley Venture Partners	19	128	14.8	29	13
Alta Partners	17	148	11.5	30	24
HealthCare Ventures	16	171	9.4	31	34
TL Ventures	15	149	10.1	32	32
Trinity Ventures	15	146	10.3	33	30
Morgenthaler	15	140	10.7	34	28
Draper Fisher Jurvetson	14	126	11.1	35	26
Highland Capital Partners	14	120	11.7	36	23
Technology Crossover Ventures	12	142	8.5	37	36
Warburg Pincus	11	188	5.9	38	39
Canaan Partners	10	135	7.4	39	37
Summit Partners	6	142	4.2	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. The number of serial entrepreneurs and total entrepreneurs funded on the sample are reported, as well as their ratio.

Table 4
Summary statistics.

Panel A: Sample characteristics

	All ventures	All first ventures	Entrepreneurs with one venture	Serial entrepreneurs	
				First venture	Later ventures
Characteristics of all ventures:					
Success rate	0.257	0.253	0.243	0.367***	0.291***
Pre-money valuation (in mil of 2000$)	15.52	16.00	15.82	17.80*	12.01***
Firm in start-up stage	0.133	0.125	0.128	0.095***	0.197***
Firm in development stage	0.306	0.298	0.299	0.293	0.373***
Firm in beta stage	0.041	0.041	0.041	0.036	0.049
Firm in shipping stage	0.450	0.461	0.461	0.463	0.352***
Firm in profitable stage	0.065	0.069	0.067	0.101***	0.029***
Firm in re-start stage	0.005	0.006	0.005	0.012	0.000***
California-based company	0.449	0.431	0.418	0.581***	0.597***
Massachusetts-based company	0.119	0.118	0.118	0.123	0.120
Age of firm (in months)	34.88	36.62	36.29	40.33*	20.19***
Previous deals by VC firm	52.41	51.45	51.87	46.69***	60.51***
Previous deals by VC firm relative to year average	2.95	2.90	2.89	2.98	3.38***
Characteristics of later ventures:					
Time between start of 1st and 2nd ventures (years)					5.33
Percentage successful in initial venture					0.367
Percentage funded by same VC in later venture					0.226
Percentage with 2nd venture in same industry as 1st venture					0.606
Observations	9,790	8,753	8,045	708	1,037

Panel B: Number of observations

Unique companies	3,796
Serial entrepreneurs	708
Entrepreneurs with one venture	8,045
Entrepreneur-company combinations	9,790
Entrepreneur-company combinations (initial ventures only)	8,753
Company-venture capital firm combinations	6,025
Entrepreneur-company-venture capital firm combinations	18,829

This table reports summary statistics for the key variables in the analysis. One observation per entrepreneur-company pair.

***, * Indicate significant difference from mean value of entrepreneurs with only one venture at the 1% and 10% level, respectively.

entrepreneurs in their later ventures. Summary statistics are presented at the entrepreneur-company level. Panel B presents the number of observations for the various subsamples we analyze.

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 36.7% in their first ventures. It is more interesting that in their subsequent ventures they have a significantly higher success rate (29.1%) 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 46% of first-time ventures receive initial venture capital funding at an early stage (meaning they are classified as "start-up," "developing product," or "beta testing," and not yet "profitable" or "shipping product"), 62% 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—20 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: $12.0 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, in their subsequent ventures. The last row in this section of Panel A 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 in their subsequent ventures have nearly three times the average experience of the average firm investing in the same year. The year-adjusted experience of venture capital firms investing in subsequent ventures of serial entrepreneurs is more than 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

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[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.

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 have also been linked to outcomes.

The bottom of Panel A of Table 4 presents summary statistics on the characteristics of later ventures. On average, the time between the start of the entrepreneurs' first and second ventures is more than five years, suggesting that serial entrepreneurs in the sample spend a fairly substantial amount of time with their initial venture. Relatively few VCs funding later ventures have private knowledge about the serial entrepreneurs, since only 23% of serial entrepreneurs were funded in later ventures by VCs who funded their earlier ventures.

3. Findings

3.1. 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 the 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 with fixed 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 0.040, indicating that entrepreneurs in second or later ventures have a 4.0% 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 one 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

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[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.

Table 5

Venture success rates.

	(1) Probit	(2) Probit	(3) Probit	(4) Probit	(5) Probit	(6) Probit	(7) Probit	(8) Probit	(9) Probit
LATER VENTURE	0.0395 [2.70]***	0.0086 [0.48]		−0.0091 [0.45]		−0.0019 [0.09]		0.0159 [0.69]	−0.0108 [0.56]
PRIOR SUCCESS		0.0842 [2.89]***		0.1082 [3.19]***		0.1300 [3.70]***		0.0862 [2.43]**	0.0881 [2.69]***
Any entrepreneur in LATER VENTURE			0.0380 [2.14]**		0.0117 [0.51]		0.0345 [1.53]		
Any entrepreneur has PRIOR SUCCESS			0.0782 [2.99]***		0.1012 [3.03]***		0.1179 [3.50]***		
VC FIRM EXPERIENCE	0.0377 [4.50]***	0.0375 [4.49]***	0.0349 [5.67]***			0.0381 [4.49]***	0.0385 [5.33]***	0.0375 [4.48]***	0.0372 [4.44]***
VC FIRM EXPERIENCE X LATER VENTURE						0.0143 [0.86]			
VC FIRM EXPERIENCE X PRIOR SUCCESS						−0.0482 [2.11]**			
VC FIRM EXPERIENCE X Any entrep. in later venture							0.0042 [0.54]		
VC FIRM EXPERIENCE X Any entrep. has PRIOR SUCCESS							−0.0403 [1.82]*		
LESS THAN THREE								−0.0189 [0.54]	
PRIOR SUCCESS X LESS THAN THREE								−0.0138 [0.23]	
VC FUNDED PAST VENTURE									0.0867 [1.99]**
PRIOR SUCCESS X VC FUNDED PAST VENTURE									−0.0066 [0.11]
Controls for:									
VC Firm fixed effects	No	No	No	Yes	Yes	No	No	No	No
Company and round characteristics	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Log-likelihood	−4821.3	−4817.0	−1619.4	−9175.4	−2739.4	−4814.9	−1617.1	−4816.5	−4813.6
χ^2-Statistic	373.1	377.6	529.3	989.0	1004.9	378.6	528.3	378.5	384.6
p-Value	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Observations	9,790	9,790	3,796	18,829	6,025	9,790	3,796	9,790	9,790

The sample consists of 9,790 ventures by 8,753 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 or filed to go public by December 2000. *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 2007 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 has 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 2007 and zero otherwise. *VC FIRM EXPERIENCE* is the difference between the log of one plus the number of investments made by venture capital organization *f* prior to year *t* and the average in year *t* of the log of one plus the number of investments made by all organizations prior to year *t*. *VC FUNDED PAST VENTURE* is an indicator variable that takes the value of one if at least one venture capital firm funding the current portfolio company funded the entrepreneur's previous company and zero otherwise. *LESS THAN THREE* is an indicator variable that takes the value of one if the entrepreneur's previous company was founded less than three years before the current company was and zero otherwise. The sample analyzed in columns 1, 2, 6, 8, and 9 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. All regressions also include controls for company age, company location, company stage, round, industry, and year.

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.

of entrepreneurs with a track record of success is 30.3%, compared to only 21.8% 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. Thus, the number of observations falls to 3,796.

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 30.7%, whereas those with entrepreneurs who failed in prior ventures have a 21.3% success rate, and companies with first-time entrepreneurs have a 17.1% chance of success. There is a modest (0.038), statistically significant effect of entrepreneurial experience on performance and a large (0.078), 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 21.7%, while at the 25th percentile, the predicted success rate is only 16.5%. There are a number of reasons why more experienced venture capital firms may make more successful investments.

VC EXPERIENCE is 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. In the fourth column, we expand the sample to the entrepreneur-company-VC level (18,829 observations) and in the fifth column the sample is the company-VC level (6,025 observations). This allows us to control for VC firm quality directly, using venture capital firm fixed effects. With the inclusion of these 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 17.5%. The predicted success rate for failed serial entrepreneurs in later ventures is 18.7%, and it is 28.9% 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 columns 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 32.2% when funded by more experienced venture capital firms (at the 75th percentile of *VC EXPERIENCE*) and 31.6% 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 14.3% 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.

We can only observe outcomes for successful serial founders that receive funding. Since venture capital funding is not random, it is possible that venture capitalists have more information about previously successful entrepreneurs. This suggests an alternative explanation of our findings: Previously successful entrepreneurs who get funded are not better than other entrepreneurs, but are funded by better informed VCs. For example, VCs might be better informed about previously successful entrepreneurs if additional information is revealed only when the initial venture goes public.[4]

We propose two tests of this alternative explanation. First, for entrepreneurs who start their second ventures very quickly, there is very little time for VCs to learn about the entrepreneur. Even though the business was ultimately successful, information on entrepreneurial ability is less likely to be revealed if the observation period is shorter. We create a dummy variable *LESS THAN THREE* which takes the value one if the current company was founded less than three years after the entrepreneur's previous company. When *PRIOR SUCCESS* and *LESS THAN THREE* are interacted, the sum of the interaction

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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	0.8730 [9.80]***						
Predicted success		0.3058 [3.52]***	0.2821 [2.71]**	0.4109 [6.46]***	0.2983 [3.54]***	0.2742 [2.71]**	0.4107 [6.81]***
Residual success					0.0746 [2.28]**	0.0703 [2.69]**	0.0792 [2.37]**
VC FIRM EXPERIENCE		0.0340 [3.54]***	0.0388 [4.22]***	0.0319 [2.83]***	0.0334 [3.36]***	0.0379 [3.92]***	0.0307 [2.73]**
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	1,037	1,037	1,037	1,037	1,037	1,037	1,037
R-squared	0.07	0.16	0.26	0.06	0.17	0.26	0.06

The sample consists of 1,037 second or later ventures 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 portfolio company went public or filled to go public by December 2000, 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 one plus the number of investments made by venture capital organization f prior to year t and the average in year t of the log of one plus the 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.

coefficient and the coefficient on PRIOR SUCCESS remains positive (the interaction coefficient is negative but not statistically significant, as shown in Table 5, column 8). Thus, even entrepreneurs who launch their second ventures very quickly with limited opportunities for information revelation are more likely to achieve success on their later ventures.

Second, we examined the relationship between success and the history between the serial entrepreneurs and the venture capitalists. The alternative explanation suggests that firms funded by venture capitalists who had previously funded successful ventures led by the same entrepreneur would be particularly successful, since these VCs have more information about the first venture. We create a dummy variable VC FUNDED PAST VENTURE, which is equal to one if at least one VC firm funded the entrepreneur's prior venture and is also funding the current venture. When this dummy is included in the specification (Table 5, column 9), it has a positive coefficient which indicates that more informed VCs are, in fact, better able to identify entrepreneurs who will succeed. Nevertheless, the coefficient on prior success remains positive and statistically significant. If the persistence of entrepreneurial success is explained by additional screening of serial entrepreneurs, we would expect that VCs would be more likely to be successful when reinvesting in previously successful entrepreneurs. We find no evidence that firms funded by the same VCs who funded serial entrepreneurs' previous *successful* ventures were any more successful (the coefficient on the interaction of PRIOR SUCCESS and VC FUNDED PAST

VENTURE is negative and not statistically significant). It does not appear to be the case that better informed VCs do any additional screening on previously successful entrepreneurs. Thus, our results on the persistence of entrepreneurial success are not driven by increased information revelation about successful entrepreneurs to a subset of better informed VCs. Of course, it is possible that additional information about successful entrepreneurs is revealed to all VCs, and not just to those who funded the venture.

3.2. 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." As noted above, 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 one. While the dependent variable in Table 6 is a binary variable, we estimate an Ordinary Least Squares (OLS) specification due to the high number of binary control variables. The number of observations in Table 6 falls to 1,037, since we are looking only at the subset of serial entrepreneurs.

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." This measure may capture the entrepreneur's management skill, the quality of the entrepreneur's business idea, the entrepreneur's ability to attract talented employees, or anything relating to building a business that is unrelated to overall industry timing. We do not have evidence on how long the entrepreneur stays with the business, so we cannot distinguish between these different elements of "managerial skill."

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 30.5% in his second venture, while a serial entrepreneur whose first deal was in a 25th percentile industry-year has an expected success rate of 23.7%.

We test the robustness of this finding in the third column of Table 6 by including Industry × 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" 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 has an expected success rate of 30.5% in his second venture, while a serial entrepreneur whose first deal was in the 25th percentile has an expected success rate of 23.4%, a difference of 7.1%. A significant component of persistence in serial entrepreneur success can be attributed to skill.

Hellmann and Puri (2002) find evidence that venture capitalists often replace founders with professional management, and thus, any impact of founders might be

limited. Regardless, our results suggest that the founders have a significant impact on a new venture's prospects for success.

It is tempting to associate market timing with luck. Is not 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 industry-year success rate for the current venture. The sample is limited to serial entrepreneurs. In the first three 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, "managerial" skill does not appear to be associated with "market timing" skill. In the fourth specification, the coefficient is not statistically significant, indicating that the persistent market timing is clustered in particular industry years (primarily Internet and Biotechnology).

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

Table 7
Persistence of market timing.

	(1) OLS	(2) OLS	(3) OLS	(4) OLS
Predicted success	0.1741	0.1071	0.0420	0.0232
	[3.56]***	[2.21]**	[1.82]*	[1.11]
Residual success	0.0065	0.0068	0.0054	0.0028
	[0.62]	[0.73]	[1.57]	[0.89]
VC FIRM EXPERIENCE	−0.0101	−0.0097	0.0001	−0.0001
(Prior Venture)	[2.17]**	[1.96]*	[0.03]	[0.04]
Industry controls	No	Yes	No	Yes
Year controls	No	No	Yes	Yes
Observations	1,037	1,037	1,037	1,037
R-squared	0.03	0.10	0.77	0.79

The sample consists of 1,037 second or later ventures 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 is the difference between the log of one plus the number of investments made by venture capital organization f prior to year t and the average in year t of the log of one plus the 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.

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.

We estimated additional specifications in order to be more certain that the results presented in Tables 6–8 do not reflect the dependence of observations of the same company (when a team of serial entrepreneurs founds a company). We clustered the standard errors at the portfolio-company level, rather than at the year level. We also estimated the specifications using only one observation per company. The results were consistent with those presented in the paper.

3.3. 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

Table 8
Persistence of managerial skill.

	(1) OLS	(2) OLS	(3) OLS	(4) OLS
Predicted success	0.1923 [1.80]*	0.2794 [2.50]**	0.1852 [1.70]*	0.2702 [2.38]**
Residual success	0.0701 [2.46]**	0.0684 [2.40]**	0.0701 [2.43]**	0.0681 [2.37]**
VC FIRM EXPERIENCE (Prior venture)	0.0123 [0.97]	0.0128 [1.01]	0.0101 [0.80]	0.0108 [0.85]
Industry controls	No	Yes	No	Yes
Year controls	No	No	Yes	Yes
Observations	1,037	1,037	1,037	1,037
R-squared	0.01	0.03	0.03	0.05

The sample consists of 1,037 second or later ventures 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 is the difference between the log of one plus the number of investments made by venture capital organization f prior to year t and the average in year t of the log of one plus the 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 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 (1)	(2)	OLS (3)	OLS (4)	OLS (5)	OLS (6)	OLS (7)	OLS (8)
LATER VENTURE	−0.2376 [6.51]***	−0.1870 [4.08]***	−1.1008 [10.96]***	−1.0881 [9.90]***	−1.5722 [6.83]***	−1.5359 [5.78]***	−0.0610 [0.67]	−0.1746 [1.46]
PRIOR SUCCESS		−0.1389 [2.00]**		−0.0347 [0.22]		−0.0822 [0.30]		0.2579 [1.36]
VC FIRM EXPERIENCE	−0.0486 [2.86]***	−0.0484 [2.85]***	−0.2090 [3.19]***	−0.2090 [3.19]***	−0.1247 [0.90]	−0.1249 [0.90]	−0.0510 [1.02]	−0.0502 [1.00]
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	0.0700	0.0702	0.0635	0.0635	0.1967	0.1967	0.7168	0.7171
Observations	9,790	9,790	9,790	9,790	2,367	2,367	2,367	2,367

The sample consists of 9,790 ventures by 8,753 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) start-up, (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 2007 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% and 5% level, respectively.

Table 10
Pre-Money Valuations.

	(1) OLS	(2) OLS	(3) OLS	(4) OLS	(5) OLS	(6) OLS	(7) OLS	(8) OLS
LATER VENTURE	−0.0467 [1.22]		0.0126 [0.39]		−0.0620 [1.31]			
PRIOR SUCCESS	0.0278 [0.48]		−0.0694 [1.21]		0.1453 [2.03]**		0.0196 [0.33]	0.1246 [1.70]*
Any entrepreneur in LATER VENTURE		−0.0511 [1.17]		−0.0116 [0.26]		−0.0611 [1.08]		
Any entrepreneur has PRIOR SUCCESS		0.0363 [0.60]		−0.0452 [0.68]		0.1893 [2.42]**		
VC FIRM EXPERIENCE	0.0947 [5.06]***	0.1186 [7.29]***			0.0988 [5.18]***	0.1367 [7.14]***	0.0776 [2.48]**	0.1284 [3.63]***
VC FIRM EXPERIENCE X LATER VENTURE					0.0187 [0.57]			
VC FIRM EXPERIENCE X PRIOR SUCCESS					−0.1355 [2.70]***			−0.1240 [2.39]**
VC FIRM EXPERIENCE X Any entrepreneur in LATER VENTURE						0.0102 [0.24]		
VC FIRM EXPERIENCE X Any entrepreneur has PRIOR SUCCESS						−0.1841 [3.23]***		
Logarithm of value-weighted industry index	0.4796 [4.55]***	0.3736 [3.94]***	0.2943 [4.14]***	0.2084 [1.81]*	0.4799 [4.56]***	0.3773 [4.00]***	0.3573 [1.91]*	0.3489 [1.88]*
Controls for:								
Company age	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Company location	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Company stage	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Round number	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
VC Firm fixed effects	No	No	Yes	Yes	No	No	No	No
R-squared	0.34	0.33	0.56	0.57	0.34	0.33	0.39	0.39
Observations	6,319	2,322	15,186	4,774	6,319	2,322	753	753

The sample consists of 6,319 professional venture financings of privately held firms between 1975 and 2000 for which the valuation of the financing round was able to be determined. The dependent variable is natural logarithm of Pre-Money Valuation, defined as the product of the price paid per share in the financing round and the shares outstanding prior to the financing round, expressed in millions of current dollars. 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 2007 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 has 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 2007 and zero otherwise. VC FIRM EXPERIENCE is the difference between the log of one plus the number of investments made by venture capital organization f prior to year t and the average in year t of the log of one plus the number of investments made by all organizations prior to year t. Logarithm of Value-Weighted Industry Index is an index computed by first calculating the value-weighted average of Tobin's Q by SIC code for companies in Venture Economics and then calculating a weighted average of the industry Q for our nine industry classifications, where the weights are the relative fraction of public firms within the nine industries. The sample analyzed in columns 1 and 5 is at the entrepreneur-company level, the sample analyzed in columns 2 and 6 is at the company level, the sample analyzed in column 3 is at the entrepreneur-company-VC firm level, and the sample analyzed in column 4 is at the company-VC firm level. Columns 7 and 8 are limited to later ventures of serial entrepreneurs, and are at the entrepreneur-company 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.

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 2.9 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 Initial Public Offering (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 show, 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.

3.4. Valuation

We now examine how serial entrepreneurship and venture capital firm experience affect company valuations.[5] To analyze this question, we use the first round "pre-money" valuation as our valuation measure. Venture Source calculates this as the product of the price paid per share in the round and the shares outstanding *prior* to the financing round.[6] The pre-money valuation is the perceived net present value of the company, and therefore excludes the additional capital raised in the financing.

A company's valuation depends on numerous factors including those we can (imperfectly) observe (e.g., the stage of product development, company age, industry, location, public market valuation levels, entrepreneur's quality, and venture capital firm's quality) and those we cannot (e.g., the company's sales and assets). We are mainly interested in how measures of entrepreneur quality and venture capital firm quality affect pre-money valuation.

Table 10 presents the results of regressing the natural log of real pre-money valuation (expressed in millions of year 2000 dollars) on the above observables. Because the data include significant outliers (one valuation exceeds $600 million), we winsorize the dependent variable at the 99th percentile ($131.5 million), which is more than 15 times the median. All the regressions include industry and year fixed effects. We again consider specifications at the entrepreneur-company level (1 and 5), company level (2 and 6), the entrepreneur-company-VC firm level (3), and the company-VC firm level (4). We also limit the sample to later ventures of serial entrepreneurs (7 and 8), using observations at the entrepreneur-company level.

All of the controls have the predicted signs. Older firms and those at later stages of product development have higher valuations. In addition, when public market industry valuations are higher, venture capital valuations are also higher. The public market industry valuation is

calculated as the average market-to-book equity ratio for publicly traded firms in the same industry.[7]

Of more interest is the finding that venture capital firm experience is positively related to pre-money valuation. The effect, however, is modest. The elasticity in the first regression is approximately 9.5%. For example, the estimates from column 2 of Table 10 imply that at the 75th percentile of VC EXPERIENCE, the forecasted valuation is $9.58 million, whereas at the 25th, it is $8.28 million. That more experienced firms pay more for new ventures is not surprising, given that they have higher success rates. Because there are unobservable firm characteristics that affect valuation levels (or those that are measured with error), it is likely that *VC EXPERIENCE* serves as a proxy for the characteristics that increase firm value. These characteristics, such as the entrepreneurial quality, might be unobservable to less experienced venture capital firms. Alternatively, characteristics such as sales or assets could be observable to market participants, but unobservable to us given the data we have. If more experienced venture capital firms invest in more mature firms in ways we do not fully capture with our company stage controls, this could explain our finding.

The finding that new ventures funded by more experienced venture capital firms invest at higher pre-money valuations needs to be reconciled with Hsu's (2004) finding that more experienced venture capital firms make offers at *lower* pre-money valuations. Hsu examines a sample of new ventures that received competing offers from venture capital firms. To the extent that more experienced venture capital firms add more value to new ventures (as is consistent with our findings), they would require larger equity stakes (lower share prices) in exchange for their money and their value-added services. Thus, the offers from top-tier venture capital firms should imply lower pre-money valuations even though the companies are worth more if funded by them. Because Hsu is looking at *within-venture* offers, he is controlling for the quality of the venture. He is therefore able to isolate the effect of venture capital firm quality on valuations. Because we are looking *across* ventures, we are picking up the effect identified by Hsu, as well as the between-venture differences in quality. This may explain why the estimated effect is small.

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[5] Hsu (2004) shows that entrepreneurs have to pay more (i.e., to accept a lower valuation) to be financed by venture capitalists with better track records.

[6] Almost all venture capital financings use convertible preferred stock. This methodology for calculation of pre-money valuation implicitly assumes that the value of preferred stock's liquidation preference is zero. Thus, this common approach to calculating pre-money valuation overstates the true valuation. This bias is unlikely to vary systematically with the variables we are using in our regression analysis.

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[7] In order to do this, we need to link the Standard Industrial Classification (SIC) codes of public companies to the nine industries used in our analysis. Our procedure is to identify the SIC codes of all venture-capital-backed firms that went public within a given Venture Economics industry code. Because there are multiple SIC codes associated with each of our nine industries, we construct market-to-book ratios as a weighted average of the market-to-book ratios of the public companies in those SIC codes, where the weights are the relative fractions of firms that went public within our nine industries. For each of the public firms assigned to the industry, we compute the ratio of shareholders' equity to the market value of the equity at the beginning of the quarter. If multiple classes of common and preferred stock were outstanding, the combined value of all classes is used. In many industries, numerous small firms with significant negative earnings introduce a substantial skewness to the distribution of these ratios. Consequently, we weighted the average by equity market capitalization at the beginning of the quarter.

Somewhat surprisingly, in the first column of Table 10 we find a negative (insignificant) or no relationship between pre-money valuation and *LATER VENTURE* and *PRIOR SUCCESS*. The same is true when we conduct the analysis at the company level (column 2) and include venture capital firm fixed effects (columns 3 and 4). Given the higher success rates of previously successful entrepreneurs, one would have thought that firms associated with these entrepreneurs would have had higher valuations. Apparently this is not the case, which suggests that venture capital firms are able to buy equity in firms started by previously successful entrepreneurs at a discount.

Columns 5 and 6 of Table 10 add interactions of *VC EXPERIENCE* with measures of *PRIOR SUCCESS* and *LATER VENTURE*. The coefficient of the interaction term is negative and statistically significant. This suggests that top-tier venture capital firms are not as eager to pay for prior performance, but the magnitude of the effect is small.

The final two columns of Table 10 consider only the sample of serial entrepreneurs for which we have valuation information. Again, the coefficient of the interaction term is negative and statistically significant. Experienced venture capital firms pay more for unsuccessful serial entrepreneurs, but lower-tier VCs pay more for successful serial entrepreneurs.

The overall conclusion that we draw from Table 10 is that despite the higher success rates of entrepreneurs with successful track records, venture capital firms do not pay premiums for their companies. In part, this may reflect successful serial entrepreneurs trading off non-monetary terms. Alternately, venture firms may be providing additional services not captured in the valuation measure such as subsidizing initial costs of the venture informally or through an entrepreneur-in-residence program. Understanding why successful serial entrepreneurs do not monetize their track records remains a question for future research.

4. Conclusions

This paper shows 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 start-ups in detail. We have shown that successful entrepreneurs raise capital earlier, but what are the non-monetary terms of their financing? Does their track record result in less restrictive covenants? If there are not higher valuations for successful serial entrepreneurs, is the higher success rate enough compensation?

References

Bengtsson, O., 2007. Repeated relationships between venture capitalists and entrepreneurs. Unpublished working paper, Cornell University.

Bhide, A., 2000. The Origin and Evolution of New Businesses. Oxford University Press, Oxford.

Chatterji, A., 2009. Spawned with a silver spoon? Entrepreneurial performance and innovation in the medical device industry. Strategic Management Journal 30, 185–206.

Gompers, P., Kovner, A., Lerner, J., 2009. Specialization and success: evidence from venture capital. Journal of Economics and Management Strategy 18, 817–844.

Gompers, P., Kovner, A., Lerner, J., Scharfstein, D., 2008. Venture capital investment cycles: the impact of public markets. Journal of Financial Economics 87, 1–23.

Gompers, P., Lerner, J., Scharfstein, D., 2005. Entrepreneurial spawning: public corporations and the genesis of new ventures, 1986 to 1999. Journal of Finance 60, 577–614.

Hellmann, T., Puri, M., 2002. Venture capital and the professionalization of start-up firms: empirical evidence. Journal of Finance 57, 169–197.

Hochberg, Y., Ljungqvist, A., Lu, Y., 2007. Whom you know matters: venture capital networks and investment performance. Journal of Finance 62, 251–301.

Holtz-Eakin, D., Joulfaian, D., Rosen, H., 1994. Sticking it out: entrepreneurial survival and liquidity constraints. Journal of Political Economy 102, 53–75.

Hsu, D., 2004. What do entrepreneurs pay for venture capital affiliation?. Journal of Finance 59, 1805–1844.

Kaplan, S., Schoar, A., 2005. Private equity performance: returns, persistence and capital. Journal of Finance 60, 1791–1823.

Kaplan, S., Sensoy, B., Stromberg, P., 2009. Should investors bet on the jockey or the horse? Evidence from the evolution of firms from early business plans to public companies. Journal of Finance 64, 75–115.

Sorensen, M., 2007. How smart is smart money? A two-sided matching model of venture capital. Journal of Finance 62, 2725–2762.