



How Portfolio Size Affects Early-Stage Venture Returns

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April 2020

We analyze the portfolios of more than ten thousand Limited Partner (LP) investors on AngelList to determine the effects of portfolio size on performance. We find that having investments in more companies (i.e., by investing in individual syndicate deals or through microfunds on the platform) tends to generate higher investment returns. On average, median returns per year increase 9.0 basis points and mean returns per year increase 6.9 basis points for each additional company that an LP is exposed to. We also show that investors who participate in an AngelList Access Fund, a broad-based early-stage venture indexing strategy, tend to outperform investors who do not participate. Our results are consistent with recent theoretical models that suggest the returns from early-stage venture investing follow an $\alpha < 2$ power law.

Introduction

Andy Rachleff, co-founder of Wealthfront and Benchmark Capital, has written that “if the average VC fund barely makes money, and seed investments represent even less compelling opportunities than the ones pursued by venture capital firms, then the typical return for angels must be atrocious.”¹ This aligns with anecdotes from small-scale angel investors who have given up on startups because they’ve lost money in the handful of deals that they’ve done. As Fred Wilson of USV has written, “Early stage investing is hard. You lose more than you win.”²

¹ From his 2012 TechCrunch article [Why Angel Investors Don't Make Money](#).

² From his 2013 blog post [Venture Capital Returns](#).



Angel investing is certainly not for the faint hearted. The Startup Genome Project reported a 90% startup failure rate in 2011³, and more recently, CBInsights suggest that around 70% of startups fail looking at data through 2019⁴. To be fair, a highly-concentrated portfolio can generate enormous returns; a single investment in Uber in its earliest round generated a roughly 5,000x return on investment.⁵ However, it can be difficult to identify and access investments in the best-performing companies, and as our previous research has shown, venture returns follow a power law.⁶ Only a small number of highly successful investments account for a substantial portion of returns for the overall market.

At the overall market level though, Cambridge Associates benchmark data suggests that early-stage venture capital has outperformed public stock markets over the last ten years.⁷ AngelList's aggregate early-stage platform returns also paint a similar story: the seed investments on the platform have produced unrealized returns of around 15% a year net of fees, making for a competitive asset class especially because venture capital returns appear to be uncorrelated with public market returns.⁸

This sets up an apparent paradox: at an aggregate level early-stage venture looks like an attractive asset class to invest in, but small-scale investors frequently scorn it based on their experiences with, and returns from, investing in startups. By analyzing the performance of the Limited Partner (LP) investors on the AngelList platform we are able to resolve this paradox. Our results suggest that investors who treat early-stage venture capital as an asset class, and invest systematically into it, tend to do much better than investors who select only a few deals. In the first section of this paper, we examine thousands of LP portfolios on the platform to show that both median and mean portfolio performance increase in the number of investments made. In the second section, we look at the performance of investors in the AngelList Access Fund, an investment vehicle that broadly indexes into early-stage venture capital. We show that, across a range of year-cohorts, the typical Access Fund investor outperforms the typical investor who does not invest in an Access Fund.

³ That figure is taken from their [introduction to the Startup Genome Project](#).

⁴ CBInsights maintains a [repository on startup failure](#).

⁵ As reported in the 2019 *Wall Street Journal* article [Uber Jackpot: Inside One of the Greatest Startup Investments of All Time](#).

⁶ See our recent whitepaper [Startup Growth and Venture Returns](#).

⁷ Cambridge Associates' Venture Capital benchmarks are [publicly available](#).

⁸ AngelList is not the only institution to find this result; see also Invesco's paper [The Case for Venture Capital](#).



LP Performance by Portfolio Size

Our analysis looks at all of the LP investors on the AngelList platform, but in order to have our results not skewed by short-term investment performance, we filtered out those investors with portfolios of less than one year of effective duration.⁹ This filtration left us with a total of 10,665 investor portfolios.

We then looked at the number of underlying investments that an LP has exposure to through syndicates and microfunds. So for instance, if an investor had made investments into five syndicates, and then also a microfund that had invested in 12 companies, we counted that investor as having made $5+12 = 17$ underlying investments. We then grouped the investors by the number of underlying investments they had made and considered both the median and mean IRRs of those groups.

Figure 1 shows the relationship between median IRR to number of investments made. The coefficient of the regression term is 9.0 basis points (one basis point is one-one hundredth of a percent), implying that the typical annual return of a portfolio of 100 investments is almost 9% higher than the typical annual return of a portfolio with a single investment.

Figure 2 shows the results of a linear regression on number of portfolio investments versus mean investor IRR. The coefficient here is 6.9 basis points, meaning that the average annual return of a portfolio of 100 investments is almost 7% higher than the average annual return of a portfolio with a single investment.

Although LP performance tends to increase in the number of investments made it is important to recognize that the performance of individual investor portfolios has substantial volatility. This volatility has the tendency to limit the explanatory effect directly attributable to portfolio size. The r^2 of the linear regression fit is 0.23 for the median and 0.18 for the mean, and so we can conclude that portfolio size explains only a fraction of the difference in performance between investors.

The volatility associated with the performance of individual portfolios encourages us to go into more detail on robust, non-parametric measures of performance. Table 1 $N = \{5, 10, 25, 50, 100\}$ threshold investment counts and compared the typical performance of LPs who had more than N investments versus those with at most N investments.

⁹ Effective duration is the time t that equalizes a portfolio's TVPI v with its IRR r : $v = (1 + r)^t$. Informally, it represents the capital-weighted age of a portfolio.

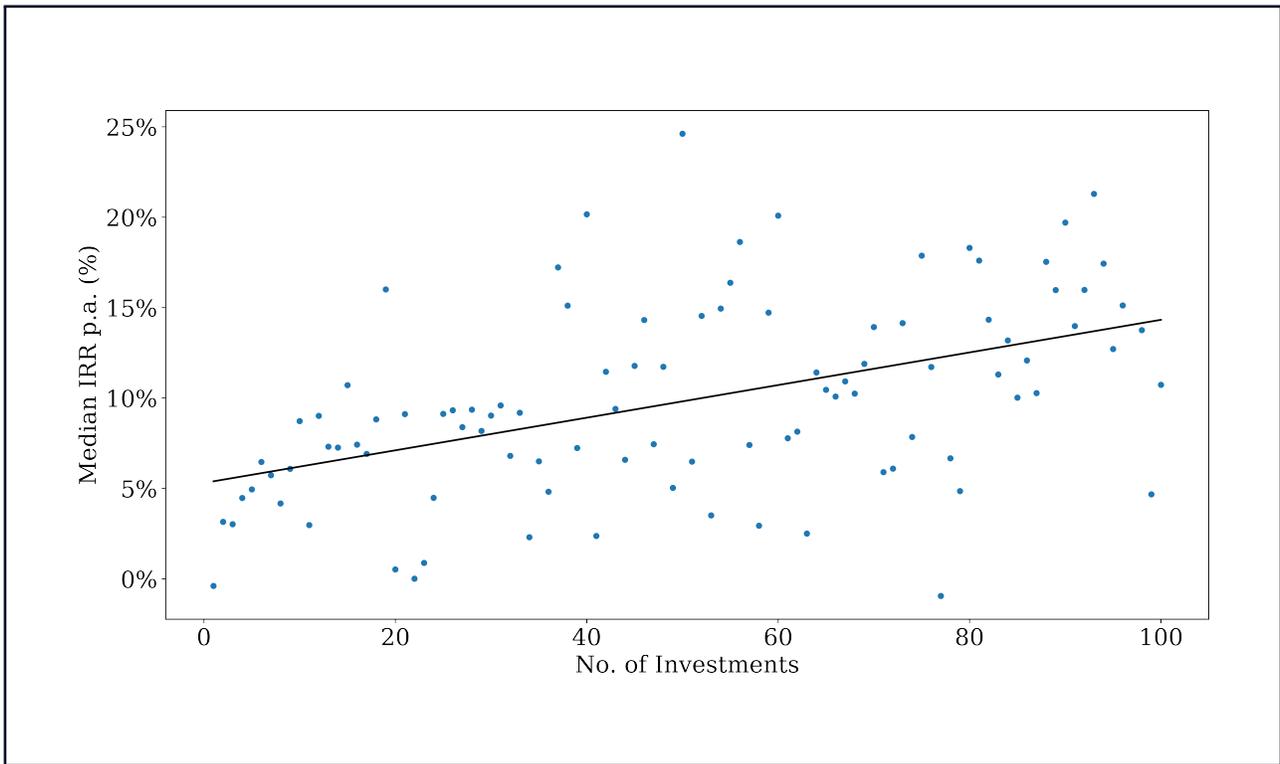


Fig. 1. A scatterplot of the median IRR p.a. of LPs with 1 to 100 investments, grouped by their number of investments. The black line is the linear regression fit.

Table 1. Investor performance when partitioned by their number of investments N . The final column is the fraction of LPs that we considered with at most N investments.

No. of Investments N	$\leq N$ Median IRR p.a.	$> N$ Median IRR p.a.	Fraction $\leq N$
5	0.0%	9.1%	0.61
10	1.0%	9.3%	0.69
25	2.0%	11.1%	0.81
50	2.9%	11.9%	0.87
100	4.1%	11.5%	0.93

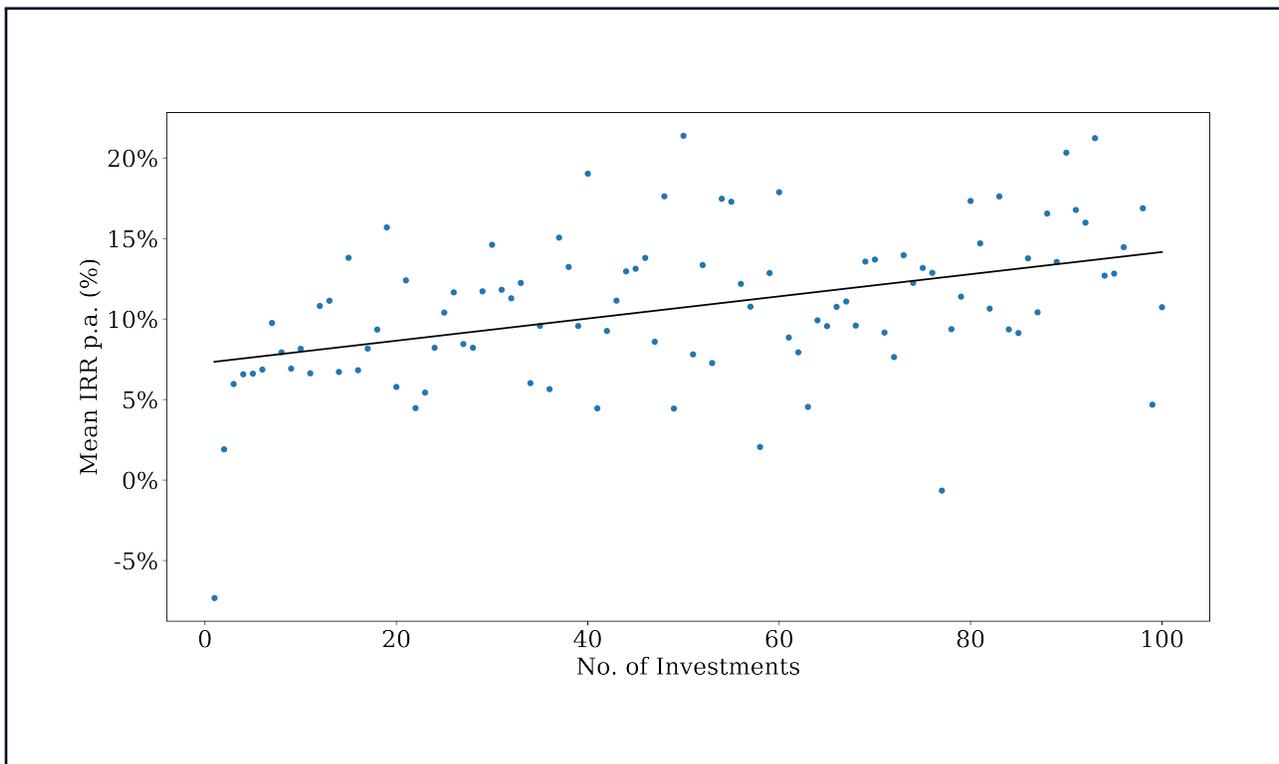


Fig. 2. A scatterplot of the mean IRR p.a. of LPs with 1 to 100 investments, grouped by their number of investments. The black line is the linear regression fit.

At each portfolio size threshold N we examined, the typical investor who had exposure to a greater number of underlying investments consistently and significantly outperformed the typical investor who invested in less than or equal to that threshold number of underlying investments. The effect is most pronounced at 5, 25, and 50 investments, where the typical portfolio with more than that threshold number of investments does about 9% better per year than the typical portfolio with fewer.

Another robust, thresholded metric is the fraction of LPs at each portfolio size that have made money investing on the AngelList platform. As Figure 3 shows that the fraction of investors with Total Value to Paid-In Capital (TVPI) greater than 1 increases with the number of investments those investors have made. Informally, an investor with TVPI of greater than 1 is “in the money” as their portfolio value is worth more (net of fees) than they paid in to it, recognizing that a significant fraction of that value is likely to be unrealized.

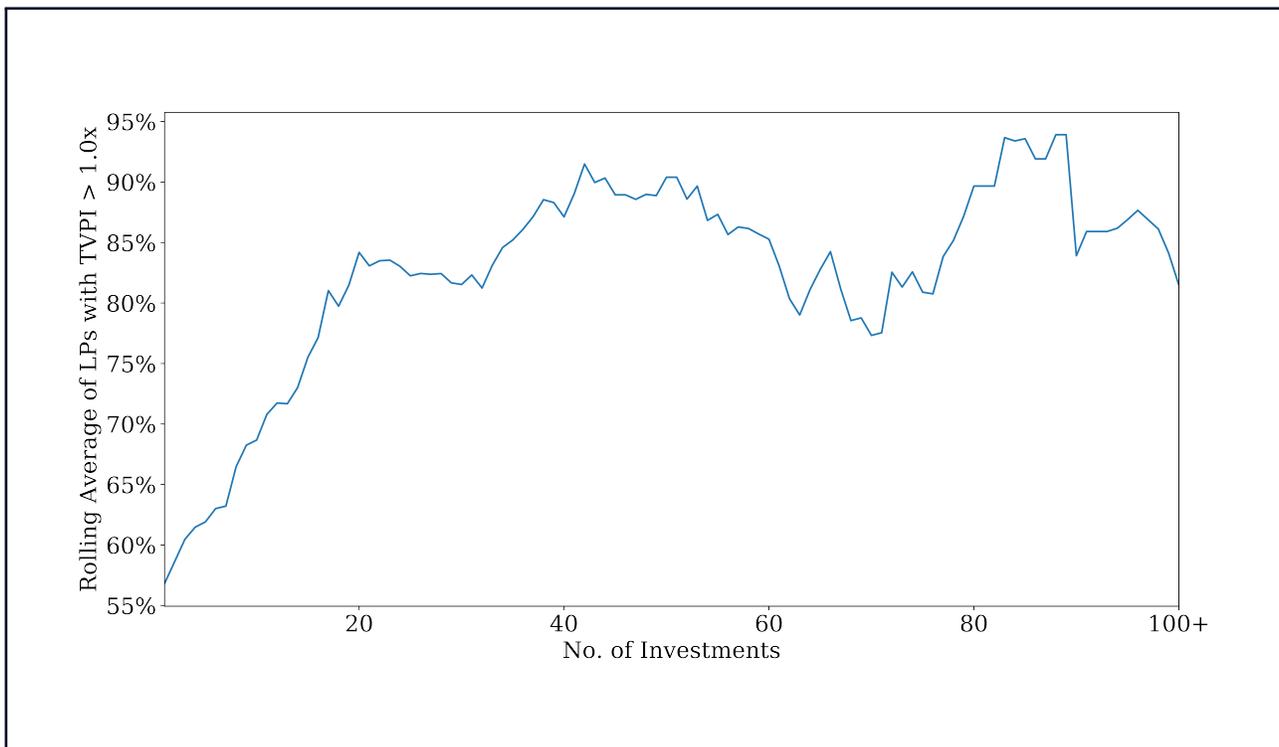


Fig. 3. Percentage of investors with TVPI greater than 1.0x (i.e., “in the money”) for different portfolio sizes. To better see the trend the line shown here is a rolling average of up to five investments higher or lower for each number of investments considered. Investors with 100 or more investments are aggregated into a single data point at “100+”.

We found that almost 90% of investors with exposure to 90 or more investments in their portfolio are “in the money” on the platform, versus less than 50% of investors with three or fewer investments. Recognizing again that, for most investors on the platform, their portfolio gains are partially or completely unrealized and may lose value in the future, this result suggests that having a greater number of underlying investments substantially mitigates the risk to investors from individual companies going to zero.

Access Fund Investor Performance

One of the most straightforward ways that an investor can get more systematic exposure to early-stage investments is through the AngelList Access Fund, an AngelList-managed fund that invests in a curated selection of microfunds and syndicates on the platform. AngelList typically launches a new Access Fund each year.



The AngelList Access Fund is managed by a three-person investment committee of notable angel investors, including AngelList founder and chairman Naval Ravikant. While the Access Fund is open to all accredited investors, because of SEC-mandated investor limits, it typically requires a minimum investment of at least \$125,000.

We split the 10,665 investor portfolios we considered into two groups: those that did and those that did not invest in (any) Access Fund, and found that Access Fund investors typically outperformed non-Access Fund investors across a range of year-cohorts. Figure 4 shows the empirical distribution of IRRs for investors in the 2013, 2014, 2015, 2016, and 2017 year-cohorts, where an investor is placed in a year-cohort based on when they made their first investment on the AngelList platform.

Figure 4 shows that the distribution of Access Fund investors is more sharply peaked, and tends to outperform, the distribution of non-Access Fund investors. Throughout year-cohorts, the mode performance of non-Access Fund investors is very close to 0% IRR, whereas the mode performance of Access Fund investors is positive. Furthermore, observe that across year-cohorts a non-trivial number of investors without Access Fund exposure have lost all or nearly all of their invested capital (i.e., with an IRR of at or near -100%).

Table 2 shows three different summary statistics for the year-cohort of individual LPs: An Access Fund AUC score, and then mean and median excess performance of Access Fund investors. The AUC score is a simple measure of separability that tells us how well performance can be used to distinguish between Access Fund investors and non-Access Fund investors. In this context it is equivalent to “The probability that a uniformly chosen access fund investor has a higher IRR than a uniformly chosen non-Access Fund investor”, when selections are made randomly within a year-cohort. AUC scores fall between 0 and 1: Scores above 0.5 indicate that the median Access Fund investor outperforms the median non-Access Fund investor, while a score of 1.0 would indicate that every Access Fund investor outperforms every non-Access Fund investor. We also considered the mean and median excess performance of Access Fund investors when compared to non-Access Fund investors. To calculate excess performance, we take the difference of mean and median IRRs between Access Fund and non-Access Fund in each year-cohort.

Across each year-cohort, Access Fund investors perform better than non-Access Fund investors both in median and mean performance. A sharper difference is observed in mean performance per year, which appears to be caused by the set of non-Access Fund investors who have lost nearly all of their invested capital.

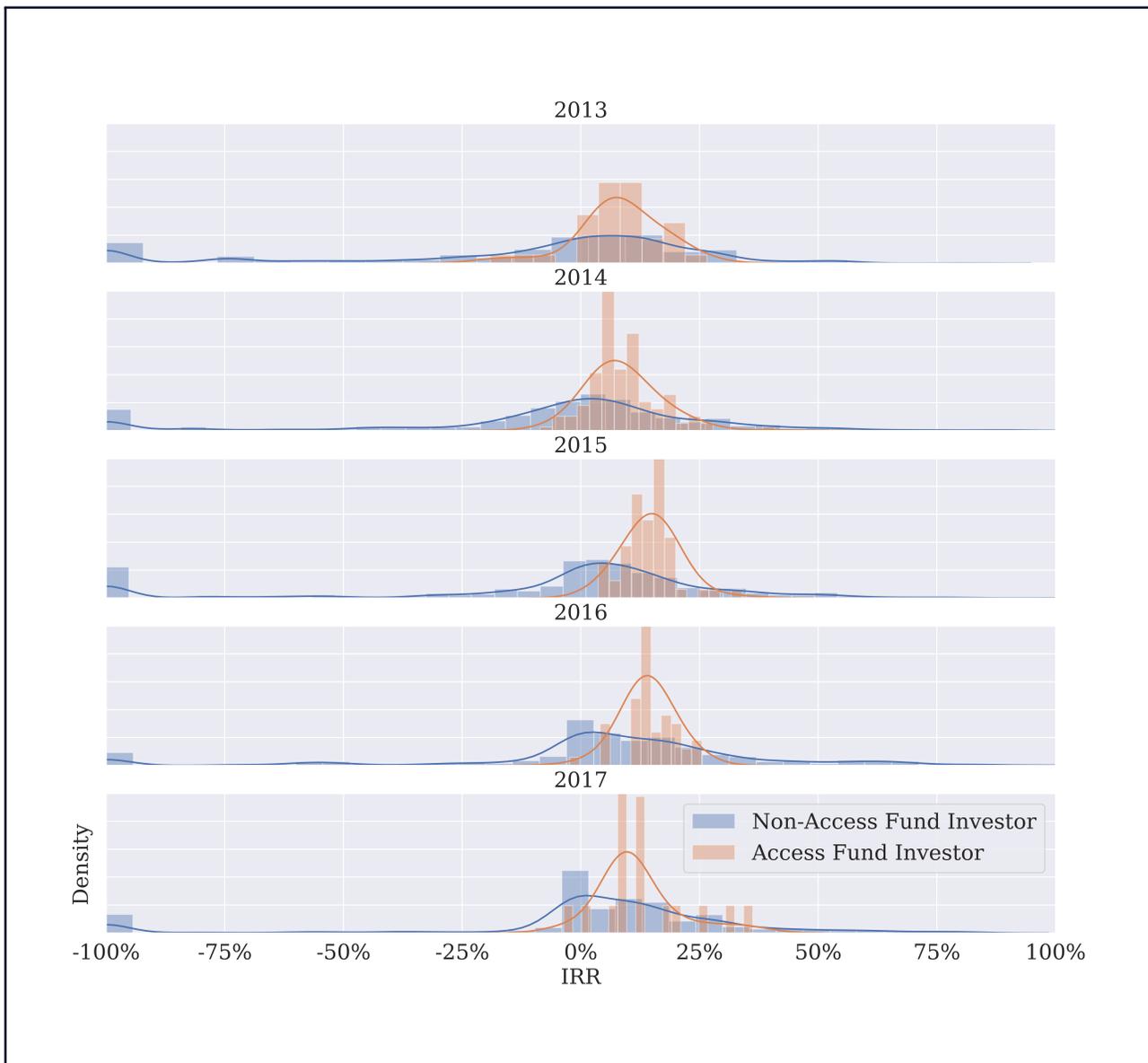


Fig. 4. IRR histogram and density distribution for investor year-cohorts grouped by whether those investors have participated in an Access Fund. From top to bottom, the sub-plots show the results for investors that made their first AngelList investment in 2013, 2014, 2015, 2016, and 2017, respectively.

Discussion of Results

Our recent research has suggested that the returns to early-stage venture capital may follow an $\alpha < 2$ power law distribution.¹⁰ This is a flavor of power law with both unbounded mean and variance. However, the

¹⁰This result and the theoretical model that produced it can be found in our whitepaper [Startup Growth and Venture Returns](#).



Table 2. AUC Scores and Median and Mean excess performance when comparing between Access Fund (AF) and non-Access Fund investors over each year-cohort.

Year of LP's First Investment	AF AUC Score	Excess AF Performance Median p.a	Excess AF Performance Mean p.a.
2013	0.65	8.1%	20.4%
2014	0.65	6.4%	13.9%
2015	0.73	11.1%	18.8%
2016	0.62	4.9%	7.9%
2017	0.61	1.5%	9.0%

arguments in that work were done on the basis of a theoretical model that was then fit to AngelList data, rather than being a direct empirical study.

It is significant then that our results in this paper, using data from real investor portfolios, is consistent with the $\alpha < 2$ power law hypothesis. While the increase in median returns with portfolio size could be expected with any right-skewed distribution (including power laws of all flavors) the increase in average returns is evidence in favor of an $\alpha < 2$ power law, whose theoretical unbounded mean manifests itself in reality with sample means that increase in portfolio size¹¹.

Of course, there is a different explanation for these results: that good investors are both more likely to have the desire (and capital) to make many early-stage investments, and also that those good investors are better at selecting good investments to make. This reasoning could also explain the success of the Access Fund, because the Access Fund's investment decisions are made by a team of sophisticated and externally recognized angel investors. That said, deciding whether or not the Access Fund or any other early-stage venture investor has "alpha" is a complex and unsettled question.¹² Regardless of explanation, our results showed evidence from real investor portfolios that a potentially replicable way of generating alpha in an early-stage venture portfolio is to simply make more investments.

¹¹See Section 1.2 of [Clauset et al. \(2009\)](#).

¹²For a fascinating discussion on whether it is even possible to evaluate alpha in venture investing, see [Judging VC Skill: The Hardest Problem in Finance](#) by Byrne Hobart.



Ben Evans from a16z has pointed out that of the fund-of-funds Horsley Bridge's more than 7,000 investments from 1985 to 2014, only 6% of deals produced at least a 10x return and that those deals made up 60% of their total returns¹³. Even in a 100-investment portfolio, which is quite large from the perspective of venture capital, just a handful of investments can be expected to produce the bulk of returns, and missing out on even a single winner is likely to be detrimental to the performance of an entire portfolio. Broad-based index funds like the AngelList Access Fund may offer a way for investors to get exposure to more startups, and therefore more winning startups, without enormous time or capital commitments.



¹³From his 2016 blog post "[In praise of failure](#)".



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The AngelList Access Fund investment committee may change without notice. Investments will generally be approved by a majority vote within the investment committee.