Reaction Wheel

Jerry Neumann's Blog

Power Laws, VC

Why do VCs insist on only investing in high-risk, high-return companies?

January 11, 2019 Jerry Neumann

Sorry this is so short. It's an interesting topic that I don't have time right now to do justice.

Last week I updated my "am I going to run out of money before I die" spreadsheet, as I've been doing every January for ten years. I need to do this because, aside from the paltry salary paid me as an adjunct professor, all of my income for quite a long time now has been capital gains from my venture portfolio. And I have no idea if any of my current or future investments will pay out a single slim dime. I *believe* they will, but belief is a thin shield between me and living in a cardboard box when I'm 90. There's zero predictability, zero ability to plan.

The VC business model sucks (especially when you don't get management fees, like me, because you're investing your own money). Not just for founders, but for VCs. Why not do something different? Why not take less risk and accept less reward, as finance theory has it? Why swing for the fences and usually strike out, why not just hit singles or doubles consistently? This is a great question, and I've been thinking about it for 22 years.

It seems straightforward: invest in companies that won't grow as fast or get as big, but fail less frequently. Even if it's hard to sell/exit a small company with

moderate growth, you could just share in the earnings or revenue. The present value of your payments should reflect the value of your share of the business and the *expected* value could be similar.

But is it so easy? There seem to be only two ways that small businesses have ever been funded by investors: bank loans and venture capital (I consider people like JP Morgan funding people like Edison venture capital, though it wasn't called that then). If there is some third way that is better, why hasn't anyone been doing it? That's not a rhetorical question (though I'm not accepting answers along the lines of "this time it's different.")

My hypothesis is that there is no third way. And my model is this:

Assume that startups, all sorts of startups not just the VC kind, end up with values chosen from a power law distribution (a "PLD"; if you really want to follow this, you can read my previous post on power laws here). A PLD is parameterized by its alpha: the lower the alpha, the fatter the tail. Different startups draw their value from PLDs with alphas that reflect their riskiness. Riskier startups have lower alpha, less risky have higher alpha.[1]

What we want to know: if the distribution of startups you are investing in are characterized by a PLD with a specific alpha, does investing in those startups have a high enough risk-adjusted expected return to be worth investing in?

1. Modern Portfolio Theory

We'll call the expected return of an investment ER_i and to risk adjust it we'll divide this by β, the riskiness of the investment. Beta is defined as $\beta = \rho_{i,m}\frac{\sigma_i}{\sigma_m}$, where $\rho_{i,m}$ is the correlation in returns between the investment and the market, σ is the standard deviation in returns, σ_i for the investment, σ_m for the market. The important point here is that $\beta \propto \sigma_i$.

For an investment to make sense, its risk-adjusted expected return must be at least the expected return of the market as a whole: $\frac{ER_i}{\beta} \geq ER_m$.[2]

2. Power Law Distribution Returns and Risk

The expected return of an investment drawn from a PLD is the mean of the PLD, $ER_i = \frac{\alpha-1}{\alpha-2}x_{min}$, which is infinite when $\alpha < 2$.

The variance is $\frac{\alpha-1}{\alpha-3}x_{min}^2$, which is infinite when $\alpha < 3$. The standard deviation is the square root of the variance, so $\beta \propto \sqrt{\frac{\alpha-1}{\alpha-3}x_{min}^2}$.

3. Risk-adjusted expected return at various alphas

a. When alpha is greater than 3, the risk-adjusted expected return is

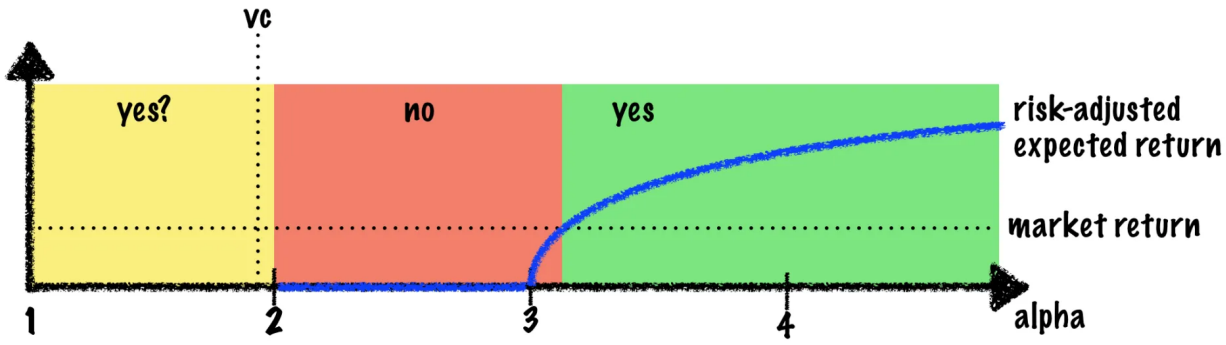
$$\frac{ER_i}{\beta} = \frac{\alpha-1}{\alpha-2}x_{min} \Big/ \sqrt{\frac{\alpha-1}{\alpha-3}x_{min}^2} = \frac{\sqrt{(\alpha-1)(\alpha-3)}}{\alpha-2}$$

If the market expected return is around 8%, then $\frac{ER_i}{\beta} > ER_m$ when alpha is slightly above 3. These are good, low-risk investments, the kind that banks traditionally made to small businesses.

b. When alpha goes below 3, the standard deviation becomes infinite, so the beta does too. Now $\frac{ER_i}{\beta} = 0$. This is less than ER_m, so these are bad investments.

c. When alpha goes below 2, the expected return also becomes infinite, so $\frac{ER_i}{\beta} = \frac{\infty}{\infty}$. This is an undefined quantity and can't be compared apples to apples to ER_m.

Are these good investments? What we know is that early stage venture funds seem to have alphas of about 1.95, just below 2 (see the post I referenced above). This is the area where venture capitalists operate.



The gap between alpha > ~3 investing and alpha < 2 investing means that using VC style investing with slightly lower-risk companies won't work, just as using small-business lending investing but with slightly higher-risk companies won't work. When alpha is between 2 and ~3, the risk adjusted expected return does not warrant investing at all.

Why don't VCs take a little less risk and settle for a little less return? Because they've already crowded up against the risk limit: if they increase their alphas by even a little bit they end up in no-go territory. Their only option is to skip all the way to alphas > 3, the much lower risk, much lower return sector.

This is a theory and a model. There are a lot of assumptions. What should you take away from this? That there may, in fact, not be a spectrum of riskiness that investors can profitably invest in. That VCs may only invest in very high-growth-potential companies in very large markets not because they are bloody-minded but because that is the best they can do given the constraints of PLDs. That the allure of medium-risk investing is perhaps an illusion.

1. I'm not going to go into why I think that if VC-backed startup values follow a PLD, then all startups must, but if you disagree then you have to posit some bright line qualitative difference between the two, and I don't think you can. ↩
2. I've assumed the risk free rate is zero. ↩

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Warning: call_user_func_array() expects parameter 1 to be a valid callback, function 'my_custom_js' not found or invalid function name in **/home/content/99/11765199/html/wp-includes/class-wp-hook.php** on line **286**