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Investment in ideas when genius and madness look alike

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Abstract

I study a situation in which investors use a noisy signal of the quality of an entrepreneur's idea in order to decide how much to invest. However, while ideas of middling quality are quite easy to evaluate, the most ingenious ideas are hard to distinguish from the most terrible ideas. This results in systematic over-investment in the very worst ideas and under-investment in the very best ideas. If the entrepreneur has a threshold for what offer of funding they are willing to accept, the very worst ideas are more likely to be funded than much better ideas. Some known quirks of investment return patters can be explained in this framework, without asymmetric information.

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1 Introduction

"Today, decades later, Amazon is worth around 1,000 times as much as it was at the time of its IPO." (*TechCrunch*, June 6, 2017)

"Bad IPO! Pets.com Doggie Flogged Despite Lovable Branding Face" (*TheStreet*, Feb. 15, 2000)

When we read about mature companies founded on transformative innovation, we are often told how much money we would have made if we had only invested early. This trope tells us that if we had only invested a thousand dollars in the company twenty years ago, we would be rich many times over. However, equally is corporate history littered with high-profile disasters, companies that appeared to have a killer product but ultimately lost everything. The history of the dot-com boom of the late 1990s is littered with examples of both extremes. How rich we would be if only we had invested early in Amazon—but how much we would have lost if we had invested early in Pets.com.

One explanation for this phenomenon is simply that innovation is risky. In this note, I propose a complementary hypothesis that explains an more intensely bimodal set of outcomes for exotic new ideas. This model is arguably closer that the standard to how novel ideas are actually received. More pertinently, it is an extremely parsimonious explanation for evidence that investment returns are bimodal and fat-tailed (Demirel and Mazzucato, 2010; Allen and Hevert, 2007; Dickson and Giglierano, 1986).

The basic idea is that the most radical ideas can look a little bit like genius and a little bit like madness. To capture this, I propose a model in which extremely high and extremely low quality ideas are hard to distinguish from each other. This is in addition to the usual assumption of general, local noise in the evaluation of an idea's quality. With this framework I am trying to capture the idea that there arise middling ideas that are easy to grasp and evaluate, but that there also arise ideas that are so novel that it is hard to tell whether they are a revolutionary stroke of genius or a crackpot waste of time.

A few predictions come out of the model. The first set of predictions are about how ideas of different quality will look in hindsight. Thinking about true quality, the ideas that were of the very best and very worst true quality will seem to have been, on average, misjudged. The very best quality ideas will have been underrated on average, and the very worst ideas will have been overrated on average.

Next, thinking about the signal or perception of quality: although the signal of quality is correct on average, mistakes are large and skewed. The true quality of the ideas with the best signals of quality will be skewed downwards by some ex post disasters, while the ideas with the worst signals of quality will be skewed upwards by some ex post surprise successes. Ideas with middling signals of quality will have true quality symmetrically distributed around the ex post truth. These patterns and the mechanism driving them are consistent with evidence in Lowry et al. (2010) that the extremely high variability in initial IPO returns is driven particularly by young, small, and technology firms that they class as "difficult-to-value".

The second set of predictions are about an application in which investors offer funding to an entrepreneur after observing a common signal of its quality. If the entrepreneur will accept any investment amount, then investment levels follow the same patterns with respect to true quality as I have just described for perceived quality. However, things are different if the entrepreneur has some threshold for their willingness to accept—perhaps an outside option makes them reluctant to accept investment they consider too stingy, or perhaps they have another idea in hand to move on to instead. If that is the case, then some ideas will go unfunded because the offer by the investors is unacceptable to the entrepreneur.

Where are these 'missing ideas'? If the entrepreneur has a fixed threshold for their willingness to accept, the missing ideas are likeliest to be those that are mediocre but not terrible. The very worst ideas are more likely to be funded than the mediocre ones. If the entrepreneur has a willingness to accept that is proportional to the idea's quality signal, the missing ideas are likeliest to be the very best ideas. They are cursed by their entanglement with the very worst. This truncation of the range of ideas that are funded offers an explanation for greater variation in returns to private early stage companies relative to venture capital backed early stage companies (Keeley and Turki, 1993).

2 A quality spectrum with connected endpoints

The quality q of an idea is between 0 to 1. The endpoints of the spectrum are connected. When a signal of quality $\tilde{q}$ is observed, we know that the true quality q is somewhere in a uniform distribution of width w that is centered on $\tilde{q}$.

On this circular spectrum, the underlying quality that generated a signal of quality close to the connected endpoints could be either very low, close to 0, or very high, close to 1. For example, when the signal of quality is precisely $\tilde{q} = 0$ *or* $\tilde{q} = 1$, we learn that true quality is somewhere in a piecemeal uniform distribution over $[1 - \frac{1}{2}w, 1]$ and $[0, \frac{1}{2}w]$. This captures the central assumption of the model that the very best and the very worst ideas are indistinguishable.

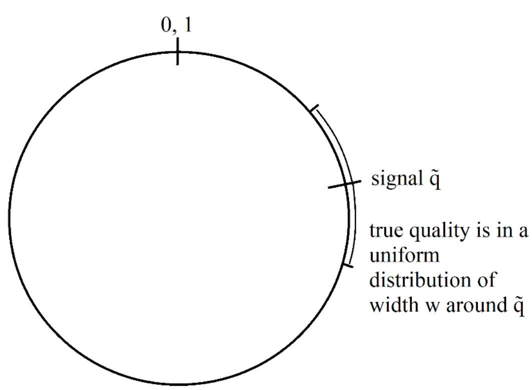


Figure 1: The quality spectrum and an example of a signal $\tilde{q}$

Figure 1 shows an example of a quality signal and the window of possible true qualities that it implies.

3 Expected quality from the signal

Let the width of the distribution conditional on $\tilde{q}$ be $w = \frac{1}{2}$. Figure 2 shows how $E(q)$ depends on $\tilde{q}$. For intermediate $\tilde{q}$, the uniform distribution implied by the signal is centered on the signal, and so $E(q) = \tilde{q}$. For more extreme $\tilde{q}$, expected quality also accounts for the part of the piecemeal uniform distribution at the opposite end of the quality spectrum.

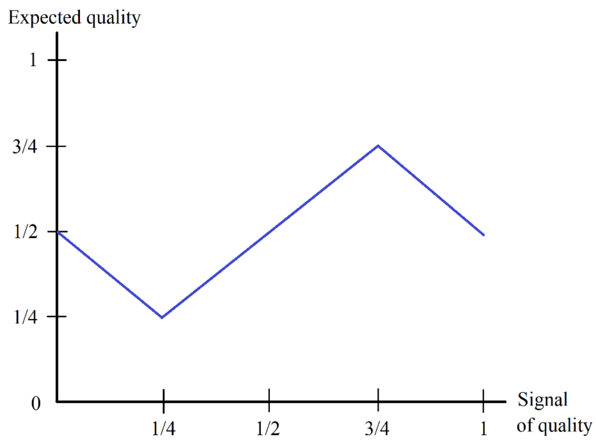
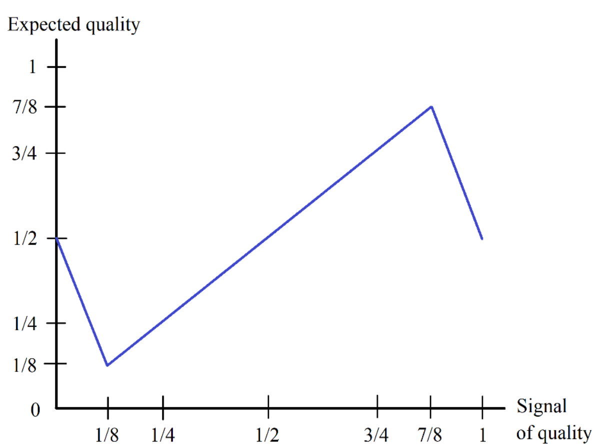
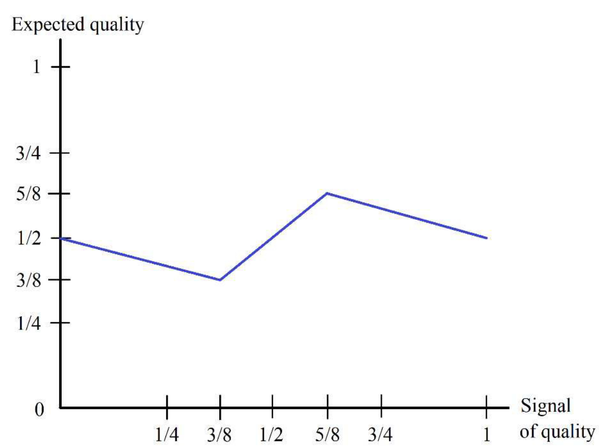


Figure 2: Expected quality conditional on a given signal, $w = \frac{1}{2}$

The width of the uniform distribution around the signal $\tilde{q}$, which we can view as capturing the extent of uncertainty in the evaluation of quality, matters for the shape of the expected quality assessment in two ways. The smaller the width, the fewer $\tilde{q}$ cases are subject to the high-low uncertainty close to 0 and 1. And the smaller the width, the lower are the lowest possible assessments of quality. To see these effects, we can compare Figure 2 to two further examples for $w = \frac{1}{4}$ in Figure 3a and $w = \frac{3}{4}$ in Figure 3b.



(a) Width of signal window $w = \frac{1}{4}$



(b) Width of signal window $w = \frac{3}{4}$

Figure 3: Expected quality conditional on a given signal

4 Investment in ideas

As an example of the model, say that an entrepreneur is seeking funding for an idea. They are completely credit constrained, and so they will rely on the outside funding of a pool of identical, competitive, risk neutral investors. The outside option for the entrepreneur is zero. The investors receive the signal $\tilde{q}$ and form expectation $E(q)$ as in the previous section. The value of the project to an investor is its true quality, which is somewhere within the uniform distribution implied by the signal.

Since investors compete away gains, the entrepreneur receives offers $E(q)$. All projects are funded since for the moment I am assuming that the entrepreneur will accept any funding offer, and all signals are associated with positive expected value to investors. While signals and therefore assessments of quality are indeed correct on average, the projects for which the signal was close to the endpoints of the quality spectrum display skewed return patterns. Projects for which the signal of quality was lowest either slightly underperform or vastly overperform relative to the signal. Projects for which the signal of quality was highest either slightly overperform or vastly underperform relative to the signal.

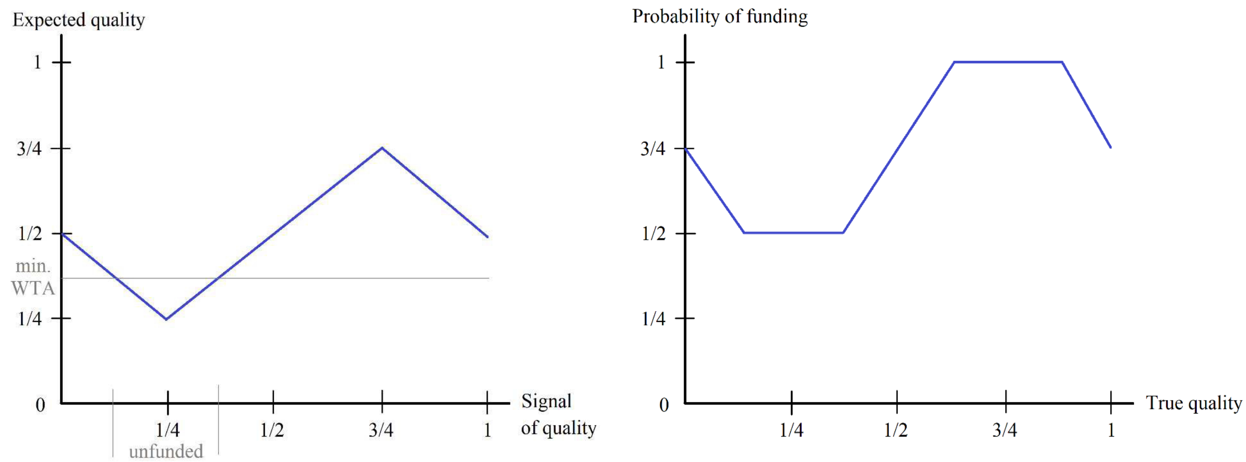
If we consider ex post quality rather than the signal, there is a slightly different pattern. Projects for which true quality is lowest make sure losses for investors: even if the signal is close to the true quality, the possibility of genius lifts up $E(q)$ to generate rational ex ante overinvestment. On the other hand, projects for which true quality is highest make sure gains for investors. Again, even if the signal is close to true quality, the possibility of madness depresses $E(q)$ to generate rational ex ante underinvestment.

In sum, after the dust has settled investment levels will seem odd in two distinct ways. First, compared to what was known at the time—the signal of quality—returns will seem systematically skewed in one direction or another. Second, compared to what was learned about the project—the true quality—investment levels will seem to have been too conservative in both the upside and downside directions. The genius-madness ambiguity in the model therefore provides a plausible and parsimonious implementation of the Lowry et al. (2010) "difficult-to-value" class that drives extreme variability in initial IPO returns.

4.1 Willingness to accept above a fixed threshold

What if the entrepreneur will not accept any offered investment, but has some reserve level in mind? This could be due to an outside option, or the ability to self-finance to some extent. In that case, we may consider which projects end up being funded by investors at all, and which go unfunded by investors and end up being shelved or self-funded.

Say that the minimum willingness to accept by the entrepreneur is some threshold less than $\frac{1}{2}$. If the investors offer less than the threshold, the entrepreneur rejects the offer. This means that some projects will go unfunded. However, the very worst projects are not the most susceptible to this. Those that are most likely dip below the threshold will be those for which the quality signal is low but not too low, as illustrated in Figure 4b. The very worst projects are likelier to be funded than the merely mediocre. This is because the worst ideas are likelier than mediocre ideas to generate signals that wrongly indicate them to be of very high quality.



(a) Unfunded projects by signal

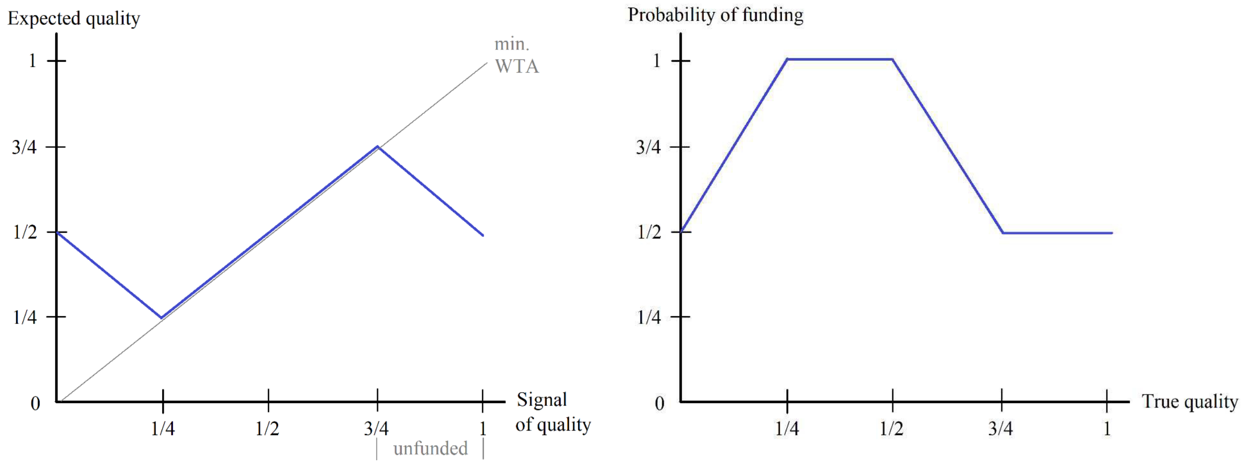
(b) Probability of funding by true quality

Figure 4: Unfunded projects when entrepreneur rejects offer less than a fixed threshold

In the threshold case, less precision in the quality signal received by investors—a wider uniform distribution of possible quality conditional on $\tilde{q}$—means more projects are funded. This somewhat counterintuitive implication arises for two reasons. First, any project that generates a low signal is being pulled up by the ambiguity between the lowest and highest quality. Second, the greater the uncertainty, the likelier it is that no signal generates an expected quality $E(q)$ less than a given threshold. In Figure 3b, for instance, expected quality is greater $\frac{3}{8}$ for any signal, while Figure 4a shows $E(q)$ dipping below this threshold for some $\tilde{q}$.

4.2 Willingness to accept proportional to quality signal

If willingness to accept is proportional to quality, then we will observe a different pattern of unfunded projects. For example, let's say that the entrepreneur is not willing to accept an offer less than the signal of the project's quality. The ideas that will not be funded are likeliest to be the very best ideas.



(a) Unfunded projects by signal (b) Probability of funding by true quality

Figure 5: Unfunded projects when entrepreneur rejects offer less than signal of quality

Figure 5 shows that if the entrepreneur is unwilling to accept less than the signal of the project's quality then the ideas that are lost are likeliest to be near the top of the distribution of possible signals. Middling ideas are funded more often than ideas of the highest true quality.

In this case, and in contrast to the threshold willingness to accept case, less precision in the signal means fewer projects are funded. In this case, larger w means a greater the range of signals for which the assessment of expected quality includes the possibility of an extremely low true quality. This means that the investors' offer will be unacceptable, and in turn the greater the range and likelihood of high quality ideas being lost.

5 The possibility of asymmetric information

Finally, I emphasize that we are not considering quite realistic complications here such as investors receiving different quality signals, or the entrepreneur being able to take actions to signal true quality. Things are also a little more complicated if the entrepreneur's willingness to accept is tied to *true* quality rather than the quality signal. In that case, or in many other plausible extensions, we would have a more complicated game of asymmetric information to consider. However, what this model shows is that empirically realistic outcomes can arise even without those strategic considerations. All it takes is a small, plausible change to how noisy signals of quality are perceived.

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