

“STOCKS AS LOTTERIES: THE IMPLICATIONS OF PROBABILITY WEIGHTING FOR SECURITY PRICES” (Authors: N. Barberis, M. Huang)

The point of this note is to explain the ideas in the above research paper without using any mathematics or technical jargon (the original paper contains both). The intended reader is someone who is interested in economics and finance but who is not an academic researcher. I welcome your comments on the ideas below, whether you agree with them or not; and also on the write-up itself -- for example, please let me know if it is confusing, so that I can rework it.¹

I'll start with a short summary, and will then give the longer version.

SHORT SUMMARY

A famous idea in the field of psychology is that the brain weights probabilities in a non-linear way. In this paper, we show that, in a financial market, this implies that investors will overvalue risky assets with lottery-like payoffs. A number of recent empirical studies have provided evidence consistent with this prediction.

LONGER SUMMARY

A very basic question we have to grapple with when we're trying to understand financial markets is: How do investors think about risk? Most economists agree that the *rational* way to think about risk is to use something called the “Expected Utility” framework. In 1979, however, two psychologists, Daniel Kahneman and Amos Tversky, wrote a paper in which they argued, based on extensive evidence from experiments that they had conducted, that the Expected Utility model does not do a good job describing how people *actually* think about risk. In the same paper, they put forward a new model that, they felt, did a much better job. In the years since, their model, known as Prospect Theory, has become enormously influential – it eventually won Kahneman the Nobel Prize – and many researchers, especially psychologists, feel that, to this day, it remains the best description we have of how people think about risk.

In this paper, Ming Huang and I try to figure how stock prices will behave if investors think about risk in the way described by Prospect Theory. This isn't the only paper I've written on this topic – Prospect Theory is so rich that it's taken me and my co-authors many years and several research articles to figure out its implications for financial markets! In this particular paper, Huang and I focus on an aspect of Prospect Theory that we had ignored in our previous work – something called *probability weighting*.

What is probability weighting? If you are thinking about risk in a fully rational way, you will weight each potential outcome by its objective probability. So if an outcome has a 0.4 chance of occurring, you will attach a 0.4 weight to that outcome. However, Kahneman and Tversky argued that this *isn't* the brain's natural inclination. In their view,

¹ This is a preliminary draft. Please do not quote or cite.

the brain has a tendency to weight probabilities in a *non-linear* way -- in particular, to overweight low probability events. In short, according to probability weighting, low probability events loom large in people's minds.

In this paper, then, Huang and I build a model of a financial market in which investors engage in probability weighting when they think about risk, and use our model to figure out what happens to stock prices. Our main result is this: that, in such a financial market, investors pay very high prices for stocks that are *lottery-like* – in other words, stocks that offer a small chance of a very large payoff. And since investors pay very high prices for these stocks, they earn low returns, on average.

What is the intuition for our prediction? By taking a sizeable position in a lottery-like stock, an investor gives himself a chance – a small chance, admittedly – of becoming very wealthy. Since his brain overweights low probability events, he finds this small chance of becoming wealthy very exciting. The lottery-like stock is therefore very appealing to him and he is willing to pay a high price for it – and to accept a low average return on it.

Huang and I argue that this prediction isn't a theoretical curiosity, but that it can help us make sense of many puzzling facts about financial markets. Here is an example. Historical data show that the long-run average return on IPO stocks is surprisingly low. Why do I say "surprisingly"? Intuitively, IPO stocks seem riskier than the average stock – after all, firms that do an IPO tend to be young firms, firms whose prospects are still quite uncertain. Business school professors teach their students that riskier stocks should earn higher returns, on average, to compensate for their higher risk. This suggests that the long-run average return on IPO stocks should be high. In reality, however, it is *low* – and that's the puzzle.

Huang and I point out a clue that might help resolve this puzzle, namely that IPO stocks have *lottery-like returns*: most stocks don't perform very well after their IPO, but some – Microsoft, say, or Google – do incredibly well. So then, as I argued above, in a market where probability weighting matters, IPO stocks *should* earn low average returns. The intuition, once again, is that by taking a sizeable position in an IPO stock, you are giving yourself a chance of becoming wealthy. If your brain overweights low probability events, you find this very exciting. As a result, the IPO stock is very appealing and you are willing to pay a high price for it -- and to accept a low average return on it.

IPO underperformance isn't the only puzzle that our framework can address. Huang and I list a number of other phenomena that it can shed light on. These include the low average returns on distressed stocks, the lack of diversification in many household portfolios, the under-pricing of conglomerates relative to single-segment firms, and the apparent overpricing of out-of-the-money options.

My paper with Huang presents a new *theory* of how stock prices behave. In the meantime, a number of researchers have done *empirical* work that is related to our paper. Some researchers have tested our theory's most basic prediction – that stocks that

investors perceive as lottery-like will have low average returns. Other researchers have looked into some of the applications we mention – the overpricing of IPO stocks, the lack of diversification in household portfolios, and so on -- to see if they do indeed have something to do with a taste for lottery-like payoffs. While it is too early to declare success, the evidence that has been gathered so far seems broadly consistent with our model.