

Behavioral Aspects of Risk

Dan diBartolomeo

November 2015

Northfield Asia Seminars

Presentation Outline

- A brief history of financial risk
- Definition and semantics of investment risk
- Plausible utility functions
- Judging behavior: some sensible / some not so
- Agency problems and the appearance of risk management
 - Willful ignorance and delusion
 - Common risk measures are often just silly
 - The regulators “made me do it”

Early Conceptions of Risk

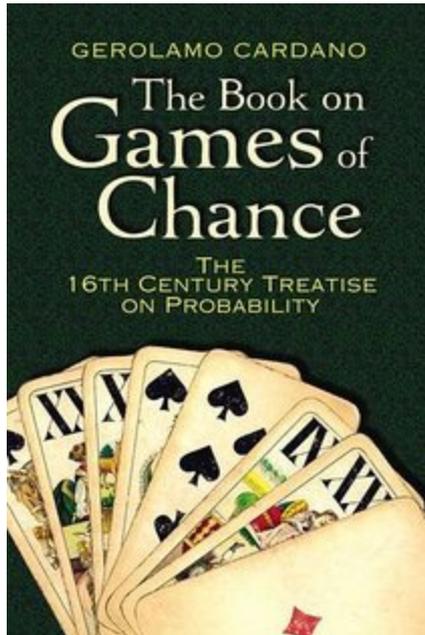


Formal concepts of risk are recent in human history

Rembrandt's "Storm on the Sea of Galilee" was a widely recognized illustration of risk during the Renaissance.

Ironically, this painting was stolen from Gardner Museum in Boston in 1990, and *was not insured*.

Other Views on Risk



- Modern views of thinking about risk in terms of probability distributions began with Cardano (1663). The background of this work includes not only gambling, but a tech breakthrough, drinking and STIs
- Nicholas Bernoulli (1713) and Daniel Bernoulli (1738) wrote about what investors wanted from investing. While they hated each other on a personal level, they agreed that investors preferred less risk to more, but *were very poor at defining exactly what risk was*
- Keynes (1923) "can only be taken as a result of animal spirits - of a spontaneous urge to action rather than inaction, and not as the outcome of a weighted average of benefits multiplied by quantitative probabilities."

Semantics for Today

- We begin by drawing a sharp semantic distinction between “risk” and “uncertainty.”
 - Let’s define risk as the precisely known probability of unfavorable outcomes from an investment. Let’s define uncertainty as our inability to precisely define that probability
- For illustration, consider two gamblers in a casino.
 - The first gambler is playing roulette, where the odds and payoffs associated with any particular bet are precisely known and do not change over time. This gambler is facing risk only.
 - Our second gambler is playing poker with both a dealer and several other players participating. This gambler is facing both risk and uncertainty. While there is some probability of losing your bet on a given hand of poker, this gambler does not know what those odds are because the odds depend on the skills and financial resources of the other players which are unknowns.

More Semantics

- Real Life
 - Consider an individual who climbs to the top of a tall building and jumps off to commit suicide. The risk of death is great but the uncertainty about the outcome is tragically small.
- Risk experts often further categorize uncertainty into “parameter estimation error” and “model risk.”
 - You only get hit by a car you don’t see coming
 - Estimation error arises because conditions change over time and our estimates of the future are based on finite samples (the past)
 - Model risk arises because *we’ve done something wrong* like use incorrect data or improper statistical methods.
- Discussions of risk should always be in the future tense.
 - There is no “risk is”, there is only “we think risk will be”

Plausible Utility Functions

- Bernoulli defined three stochastic dominants
 - Investors prefer more return rather than less.
 - Investors prefer less risk to more, but cannot define what risk is.
 - There is a decreasing marginal utility to wealth
- One mathematically tractable way to fit these requirements is to say that investors want to maximize the logarithm of their wealth *in the long run*.
 - The Taylor series approximation to log wealth is mean-variance of Markowitz and Levy (1979)
 - Risk adjusted return is *return minus some penalty for taking risk*
 - The size of the penalty is a function of the **variance** (volatility squared) of the return and the risk preferences of the investor.
 - Use of variance is a mathematical requirement of the way return compounding works. *Double the volatility is four times the risk*

A Different View

- If you are an investor with material probability of bankruptcy, you may not survive in the long run,
 - Your objective is to maximize return each day, subject to keeping the probability of failure to an acceptably low level.
 - This is sensible for banks or a leveraged hedge fund.
 - Investors with this behavior consider risk adjusted return as return **divided by the risk measure** (e.g. volatility), such as Sharpe Ratio or Information Ratio (benchmark relative).
- Mean-variance and Sharpe Ratio maximization are equivalent objectives if and only if there are no limits on leverage.
 - deGroot and Plantinga (2003) describe investor risk attitudes
 - Leverage multiplies uncertainty as well as risk

Why Mean-Variance is Popular

- Imagine you have \$1 to invest and do so at a fixed 8% annual return.
 - After 50 years, you have \$46.90, \$1 is original, \$4 is the summation of the \$.08 earned each year and \$41.90 is the result of compounding
- Now assume you start with \$1 but invest at an average of 8% with a volatility of 20%.
 - After 50 years, you will have \$18.42. \$1 is original, \$4 is the summation of the \$.08 earned each year and the \$13.42 is the result of compounding
- The difference between the \$41.90 and the \$13.42 is mathematically related to the **volatility squared or variance**.

Behavior Theories

- Prospect Theory described Kahneman and Tversky (1979) is widely misunderstood in finance.
 - PT describes how people **do behave in making decisions** that don't fit textbook definitions of economic utility (e.g. Modigliani (1963), Samuelson (1969)) if risk and uncertainty are involved.
 - **PT does not describe how people should behave.**
- Long Run or Short Run
 - Our earlier casino gambler would sensibly move from the \$50 poker table to the \$10 table if they only had \$60 left. Your willingness to take risk should vary based on how much risk you can afford to take. The optimal bet size is given in Kelly (1956). The investment version of this is the Discretionary Wealth Hypothesis of Wilcox (2003).

Principal Agent Problems

- Lots of economic theory is about how investors should behave. In the real world, most financial wealth is under the control of agents.
 - Asset management firms
 - Collective investments such as mutual funds, pension plans
 - Investment advisors, financial planners, brokers
- Most problems in investment risk management arise because it's unclear **whose risk is it any way?**
 - The investor losing their wealth
 - The asset manager losing a client
 - Board members that get embarrassed by negative publicity
 - The administrator who gets yelled at by their boss

The Result of Ambiguity

- Typical behavior toward risk perfect sense if the job of the asset manager is to keep their client from firing them.
- However if the job of the asset managers is to appropriately handle the risks to the client's investment wealth, I would argue that most practices range from **willful ignorance to delusion**.
 - We will illustrate issue this with examples
 - To further complicate matters, financial industry regulators in several countries have mandated risk reporting and control schemes adopted from commercial banking that are largely inappropriate for asset management on behalf of long term investors.

Hidden Agenda of Tracking Error

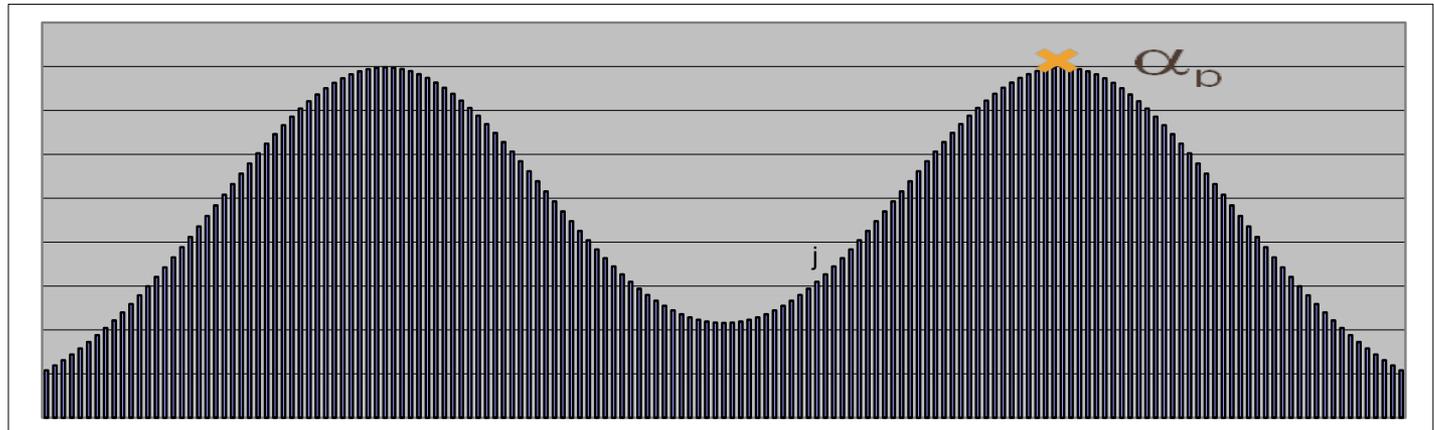
- Investor / asset manager relationships are often centered around expectation of the **information ratio** (alpha/tracking error).
 - Consider being an investor with a portfolio with expectations of $\alpha = 2$, $TE = 4$, absolute volatility = 20
 - Or $\alpha = 2$, $TE = 4$, absolute volatility = 15
 - Would any investor be indifferent? **Go back to SLIDE 9**
- Roll (1992) summarizes the problem well
 - Why would an investor care that their manager stay close to a benchmark if they were actually confident the manager could beat the benchmark?
 - Guay (2012) argued that investors hire managers to have somebody to blame when things go wrong, not because they think they actually add value.

The Central Paradox of Active Management

- The use of tracking error for index funds is clear, since it represents the standard deviation of active returns around a known mean of zero. **For active managers it simply the wrong measure because it's a standard deviation around a mean we don't know.**

*All active managers must believe their future returns will be above benchmark (or peer group average) in order to rationally pursue active management, yet it is axiomatically true that roughly half of active managers must produce below average results. **Many are wrong and we have to reflect that risk somewhere.***

A Picture for Uncertainty of Mean



The resulting distribution is bimodal with modes at α_p and $-\alpha_p$

Distribution has skew and kurtosis relative to the manager's expectation of α_p

Adjust uncertainty of mean for higher moments using Cornish-Fisher expansion (e.g. **BIG LEFT TAIL**)

Algebra Phobia

- Imagine you are an investor who asks their manager
 - “For every \$1 million I give you today, what is the probability that I will have less than \$800,000 ten years from now?”
 - Given expected returns and risk pretty much anybody with Excel can give you the answer to this common question.
- But what if you ask your manager
 - “For every \$1 million I give you today, what is the probability that I will have less than \$800,000 **at any one moment** in the next ten years?”
 - I would argue this is what most investors care about more
 - Although the algebra was published in Kritzman and Rich (2002) almost nobody can routinely answer this.

Diversification is NOT a Panacea

Inspired by Iceberg Risk by Kent Osband

Consider the correlation of two hedge funds. The two funds happen to have offices in the same building. The two PMs meet each morning at the lobby coffee shop. Each morning they flip a coin. If the coin comes up “heads” they hold exactly the same positions for that day. If the coin comes up “tails” they go long and short against each other.

On the days they hold the same positions, their return correlation will be one. On the days the two funds go long and short against each other, their correlation will be negative one.

On average, their correlation is zero, giving the false impression that they act independently.

The Regulator Made Me Do It!

- Some countries have adopted risk regulations for investors that are based on rules for commercial banks.
 - These rules focus on short term downside risk (i.e. 95% daily VaR) to ensure institutional solvency at each moment in time.
 - Long only term asset owners do not have any liabilities “at call”. Solvency is NOT the issue
 - Even pension “liabilities” are really the present value of liabilities often decades in the future.
 - Many long term asset owners such as sovereign wealth funds have no legal liabilities at all. It’s hard to go broke if you have say \$500 Billion and don’t owe anyone anything
- Imagine you are a 401K investor at age 25
 - Is it sensible that your mutual fund manager consider risk on a one day horizon?

Managing the Appearance of Risk

- Many asset owners have put an emphasis on the *appearance rather than reality* of risk management
 - A US public pension fund invited Northfield to submit a proposal for risk services, with the understanding we were precluded from any evaluation of the reasonableness of the fund's return assumptions even though we were to be fiduciaries of the plan.
 - A pension scheme in Europe sent out an RFP to risk vendors asking about their services. Our estimate of the maximum spread of the likely fees between the least and most expensive vendors was \$250K per annum, the equivalent of .0000016 of AUM of the fund. Cost was given a 30% weight in the scoring of vendor proposals, while analytical accuracy got 15%. Given \$US 150 Billion AUM, and an annual portfolio volatility of 10%, even the tiniest difference in risk accuracy was worth several orders of magnitude more than the fee difference.

More Horror Stories

- I was an expert witness in these two cases:
 - The risk officer at a California public fund brought a mathematically impossible discrepancy in risk measures to the attention of the CIO and several board members. After being ignored, he brought his suspicions about risk values published in public documents to a newspaper. The officer was dismissed for speaking to the press. Litigation over the termination is ongoing.
 - A family office in New York was sued for fraud by a group of their investors (relatives). The basis was that they had made 65% return in the last 18 months on certain assets, so the family office must have investing in very risky things, while professing that the investments were conservative. A Federal judge dismissed the case for lack of damages and all the *attorneys were fined for wasting the court's time.*

Conclusions

- Investor understanding of risk is weak and lacks a well accepted vocabulary for the more subtle aspects.
- Lack of understanding of investor objectives over the long run has lead to improper risk policies.
- The complexity of the financial services industry has obfuscated the issues of investor risk to the point that the metrics that dominate discussions are often irrelevant.
- The financial community often fails to distinguish what is descriptive of observed investor behavior, and what is appropriate investor behavior.