

Investment Analysis¹

Lecture 3: Risk and Return

David Murakami²

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¹These lecture slides are based loosely on the set of lectures by Professor Raymond da Silva Rosa.

²St Cross College, University of Oxford
Email: david.murakami@economics.ox.ac.uk

Introduction

Risk

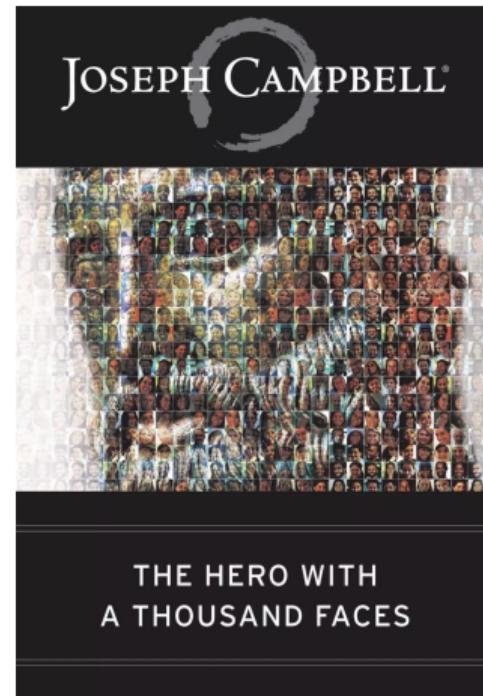
Leverage

Myth of
Time Diver-
sification

Conclusion

Today, we will look at:

- Risk and leverage
- “Hero with a Thousand Faces”
- Fallacy of time diversification



Introduction

- All investments have a fundamental structure that we need to recognise. Each may be slightly different, but they all have the same base.
- Keep this mind the next time you read a finance newspaper, and analyse what is going on – learn to criticise what you read.

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Another concept to consider: The black swan

NEW YORK TIMES BESTSELLER

SECOND EDITION

With a new section: "On Robustness and Fragility"

THE BLACK SWAN



The Impact of the
HIGHLY IMPROBABLE

Nassim Nicholas Taleb

- Risk is the probability of an outcome being different to the expected outcome.
- Most people are risk averse. But if you increase the potential return, people are more willing to undertake risk.
 - Which would you prefer? \$1,000 in hand or 50% chance of getting \$2,000 and 50% chance of nothing?
- Example: What is the market value of a toll road?
 - \$10,000 profit per day, so \$3.65 million per year
 - Bonds pay 5% interest

$$\begin{aligned}V &= \frac{\mathbb{E}\Pi}{R_f} \\&= \frac{3,650,000}{0.05} = 73,000,000\end{aligned}$$

The effect of discount factors

- But that was assuming the project was risk-free. What if we add a risk premium for the toll road, such as 3%?

$$\begin{aligned}V &= \frac{\mathbb{E}\Pi}{R^f + R^p} \\&= \frac{3,650,000}{0.08} = 45,600,000\end{aligned}$$

- So increasing the discount factor by adding in risk by even a small amount, dramatically reduces the value of the toll road.
- If the risk premium is too high, investors may not go forward with the project.
- But this is the sign of an efficient market – risks are appropriately measured, and investors may deem a project as inefficient.

Risk manifesting: a case example

<https://www.wsj.com/articles/SB10001424052702304434104579379351959645932>

“The Australian unit of U.S.-based AECOM Technology Corp. is being sued for as much as 1.6 billion Australian dollars (US\$1.4 billion) by the receiver of RiverCity Motorway Group, which funded construction of a toll road in the eastern city of Brisbane but then went bankrupt in 2011 after traffic volumes fell far short of hopes.”

- Is this a sign of market inefficiency? Probably not.

Efficient markets and risk

- In a competitive market, higher risk projects require a higher EXPECTED return to attract capital.
- In an efficient market, higher returns correlate with higher risks.
 - Risk and return relationship can be difficult to detect
 - Two kinds of errors:
 - Type 1 (false positive): project is seen as more risky than it is
 - Type 2 (false negative): project is seen as less risky than it is

Efficient markets and risk

- Without barriers to entry, high returns are a temporary phenomenon
- Where high returns persist and there no obvious barriers to entry, then it is most likely that there is correspondingly high risk
 - There are no “free lunches”
 - Being “smart” or “good” doesn’t lower risk

The Hero with a Thousand Faces

- Joseph Campbell's famous theory that myths from around the world all share a fundamental structure: the monomyth
- “Get rich” schemes share similar fundamental structure: they are either fraudulent or entail greater risk than is apparent

Thought experiment #1

- Scenario: An underdeveloped, rural economy has a stock market. The stock consists of cattle. Every March (and only in March), a small short-lived tick bites the cattle and they have a very small chance of developing a version of mad cow disease that is fatal to humans who come into contact with them. In most years, no cow contracts mad cow disease. If a cow does get diseased, it is most likely to happen early rather than later in March.
- Question: Is the typical monthly return to holding livestock in March likely to be higher or lower than in other months?

Thought experiment #2

- Scenario: 90% chance of crossing a river without getting bitten by a crocodile; bridge is a two-month long trek away. One person decides to cross the river, another decides to take the bridge.
- Question: Who is smarter?

Case example: The downfall of Jon Corzine and MF Global

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- MF Global bought high yielding European bonds in countries such as Italy, Spain, Belgium, Portugal and Ireland. MF Global believed that the countries wouldn't default on their bonds.
- MF Global used European bonds as collateral to borrow money at very low rates.
 - They then earned the spread: difference between high interest received and the low rates it paid back.
- “What The Sad Saga Of MF Global Teaches Us To Do Differently”

Case example: The downfall of Jon Corzine and MF Global

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- Puzzle: Why were lenders to MF Global willing to lend money at low interest rates when they could have bought European bonds offering higher returns?
- Answer:
 - ① MF Global's lenders might not have shared MF Global's view that the European bonds were low risk.
 - ② MF Global's lenders were lending on short-term basis and/or reserved the right to require MF Global to post more collateral (i.e., put up more money) if they got worried about default risk.
- In essence, MF Global's lenders were willing to lend at lower interest rates in return for less risk and/or greater liquidity.

The Equity Premium Puzzle

- Mehra and Prescott (1985) discovered the EPP, stating that the returns to investing in stocks over bonds is “too high” assuming standard risk preferences of investors.
- For the US during the period 1890-1979, the difference between the average return on the stock market and return on short-term government debt – the equity premium – is about 6 percent.

The Equity Premium Puzzle

- Consider the following thought experiment: Suppose you have a 50% chance of winning either \$50 or \$100 dollars. But someone offers you a certain payoff so that you do not take the gamble. How much should they pay you? You would expect that they pay you around \$75, right?
- But, if we use the discount factor on shares implied by historical stock market data, the certainty payoff is approximately \$51.21!
- How can this be?
 - This is something that is still debated to this day in academia and economic research (in the field of macroeconomics and “macro-finance”).
 - It’s an advanced topic, so we won’t dwell on it for too long. But if you want to learn more about it, we can discuss further.

Risk is not an evil

- The point that I am trying to make is that risk (and return) is a necessary trade-off we need to consider in life. You can either take on more risk, or you can choose to shy away from it. It's your choice and up to your preferences.
- But do not be surprised if risk manifests itself and you lose. This is the point about there being "no free lunches".
- Accumulating wealth without taking on risk is a slow process:
 - The "rule of 72":³

$$\text{Doubling time} \approx \frac{72}{100 \times r}$$

³This is a shortcut from the formula:

$$P_{t+n} = P_t(1 + r)^n.$$

How to get rich quick

- Some possibilities:
 - Buy a lottery ticket
 - Invent something useful, e.g., the iPhone
 - Sell a company via an IPO, e.g., Facebook
 - Identify and invest early in a company like Apple/Google/Amazon
 - Make a leveraged investment

Leverage

- Companies achieve double-digit returns to shareholders whilst earning single-digit returns on their total assets by taking on debt (i.e., increasing risk but also expected return to shareholders).
 - e.g., look at Debt/Equity ratios of publicly listed companies.
- Simple example:
 - Assets (\$100) = Equity + Debt
 - Let interest rate be 5% and earnings before interest expense be \$10.

Total Assets	Equity	Debt	Interest Expense	ROE = (\$10 - Int. Exp.)/Equity
\$100	\$100	\$0	\$0	10/100 = 0.1
\$100	\$50	\$50	\$2.5	(10 - 2.5)/50 = 0.15
\$100	\$20	\$80	\$4	(10 - 4)/20 = 0.3
\$100	\$10	\$90	\$4.5	(10 - 4.5)/10 = 0.55

Leverage

- By simply increasing your leverage (with cheap debt), you can increase your ROE. This is basics of how private equity firms run.
- Leverage is a powerful tool. It can make an ordinary investor look very impressive, despite not having special insights into the investment. However, the risk being taken on can be difficult to appreciate.
 - The trick is to find investors on the other side to fund the debt.

Carry trade

- Another example of leverage, debt, and risk are people who engage in “carry trade”, e.g., Mayumi Torii.
 - Another good (but difficult to understand) read: Koijen et al. (2018).
- JPY-AUD carry trade:
 - Borrow at 3-month JPY LIBOR (“funding currency”)
 - Invest at 3-month AUD LIBOR (“investment currency”)
 - Hope that AUD doesn’t depreciate against the JPY

Figure: AUD-JPY FX Rates



The Myth of Time Diversification

- Jack Duval wrote an interesting piece in 2006 [link] .
- Investors are often encouraged to increase their risk exposure based on a long-term horizon. The idea is that the longer an investment is held, the less likely it is to produce a loss.
- This is wrong.
- Often times, graphs are shown depicting that the longer you hold your investment, the less likely it is you will make a loss.

Explaining the myth

- So why is time diversification a myth? Jack Duval states:
 - ① Risk of end of period loss decreases with more time but this is exactly offset by size of wealth at risk
 - ② The longer you are invested in a risky asset, the more likely it is that you will suffer a loss
 - ③ Most investors are not in it for the long run. They are concerned about their short-term prospects.
- Much like how flipping a coin 20 times will not decrease the odds of flipping a tails, investing for a longer time period will not lower the chance of loss.

Explaining the myth

- Time diversification fallacy is based on a “Law of Large Numbers”-like argument.
- As the time horizon increases, so does the likelihood that an investor’s actual average return will achieve its long run historical average.

Risk and uncertainty: A fallacy of large numbers

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- Samuelson motivates the following thought experiment: Suppose there is a 100% equity portfolio which an investor finds too risky to hold for 1 year. Would it make sense for the investor to hold it for 30 years?
- No.
 - The investor's investment base or wealth will increase over time, and because the investor will keep his asset allocation the same over those 30 years, traditional time diversification claims that a potential 20% loss on a \$1 million retirement is the same as a 20% loss on a \$2,000 savings account.
 - But this is not true. Losing \$200,000 at the end of retirement is far more harmful to the investor than \$200 just out of university.
 - Therefore, the investor should not accept the risk over 30 years, unless they deem it reasonable over each time period.

Risk and uncertainty: A fallacy of large numbers

- Samuelson proved that the decrease in the probability of a loss outcome was offset by potential increases in the magnitude of the loss.
- Stocks are more risky in the long run because the cost of insuring stocks against returns lower than the risk free rate increases as the length of the investment horizon increases.
 - This can be seen by using put options as a proxy for the cost of insuring investments.
 - Risk increases over time. Or, as time increases, the potential of within-horizon losses to occur also increases.
 - Because long term time horizon portfolios require the investor to maintain a certain asset allocation pattern through the investment's life cycle, investors may lose confidence in their strategy as they experience within horizon losses.
 - This creates a tendency in which investors usually do not stay with their investments until the closing period of the investment.

Conclusion

- Recall “The Hero with a Thousand Faces”
- All investments share the same fundamental structure
- There is no such thing as a free lunch
- High risk does indeed correlate with higher returns
- Do not be surprised when the risk manifests and you lose.