# The Equity  Market Premium Puzzle

CAPM and Minimum Variance Portfolios

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# Presentation Structure

- Introduction: What's this presentation about;
- Literature Review: Behavioral & Rational explanations;
- Discussion: Expansion of CAPM to rationalize Equity MVP performance;
- Conclusions;
- References.

# Introduction

- What is the "Equity Premium Puzzle"?
- A term coined by Mehra / Prescott (1986, 2003) to describe the improbably high risk aversion one must have to own bonds given the immense equity return premium offered by equity markets.
  - They note that between 1889 & 1978 the average risk free rate was <1% and the average Equity Return was 7%.

# Define "Equity Market Premium Puzzle":

- Narrow the problem down to Equity Markets only, no bonds in the universe, only a Risk Free Rate.

- the very small marginal return per unit of risk in equity markets, demonstrated by a "flat capital market line"

  - According to Benartzi & Thaler (1993) an equity investor is indifferent between even odds of getting $100,000/$50,000 and a certain payoff of $51,200;

  - Clarke, DeSilva & Thorley (2006) document a reduction in volatility of 25% holding MVPs while maintaining comparable returns for US markets between 1968 & 2005;

  - Blitz & Van Vliet (2007) document low vol outperformance of 12% = lowest decile by vol minus the highest decile on a Global Universe on data between 1986 - 2006… 6% if we exclude tech bubble

  - $100 invested in the Northfield Fundamental Model Vol Factor Index yields $63 between 12/88 - 03/08

  - (#$%@???)… i.e. what's going on?

# The Upshot?

- In Equity markets, MVPs, leveraged up to the appropriate level of risk offer better returns than Market Portfolios:
  - The addition of MVP to an asset allocation *Increases* equity contribution to both risk & return; (Arai, 2007)
  - Domination of cap weighted indices by MVP highlights the difference between Beta and Equity premium. (Arai, 2007).

# Follow Up Questions

- Raises (at least) 2 follow up questions:
  - Is it rational to look at Equity markets in seclusion from the other assets available?
  - Can we extend the MPT structure to accommodate & rationalize this behavior?

# But First… The Literature

- Some background on possible explanations for this behavior from the
  - Behavioral finance world
  - And some of the more well known Rational Explanations…
  - So…

# What's going on?

- **Behavioral Finance:**
  - Loss aversion / Prospect theory (Benartzi & Thaler - 1993)
    - Asymmetric utilities to gain & loss based on "reference point"
  - Short term risk indifference / Crash Aversion (Barro 2005), (Gabaix 2007)
    - Long term capital appreciation trumps short term volatility
    - Risk of major crash is the only one that matters

# What's Going On? (cont…)

- Various Rational Explanations:
  - Style effects (diBartolomeo):
    - Low volatility portfolios tend to have a "value" bias;
    - value portfolios have negative skew, therefore investors expect higher than CAPM returns (CAPM assumes skew of 0) to compensate;
      - Think of momentum (buy on up, sell on down) as being analogous to CPPI, or being long a put option…
      - Then Value would be like being short a put option hence the negative skew…

# Other Rational Explanations

- Which Risk Free rate do we use?
  - CAPM assumes same rate for borrowing & lending
    - if there's a spread between borrowing & lending rates… investors would demand a higher return than predicted by CAPM to borrow money to leverage an MVP up to Market Portfolio Risk
  - Perhaps investors don't care about short term rates, but actually use longer term STRIPs
    - This would further flatten the SML…
    - Only applicable to normal, not inverted yield curve scenarios

# More Rational Explanations

- Haugen + Baker (1991) argue that Cap weighted market indices are inefficient due to increased transaction costs, taxes and restrictions on short selling.

  – They built a portfolio with of 1000 stocks with minimum variance over the trailing 24 months, then rebalanced quarterly;

  – The resultant portfolio had higher returns & lower variance than the Wiltshire 5000 during the sample period: 1972 -1989.

# Still More Rational Explanations(!)

- Wisdom from Fixed Income Markets:
  - Lochoff (1998) argues that buying at the short end of the yield curve & leveraging up to desired risk level yields higher returns due to greater marginal return per unit of risk at the short end of the curve;
  - Applying this logic to equity markets doesn't take a leap of faith:
    - Applying a PV model of future cash flows puts low vol stocks at the short end of the curve as they pay out in the short term
    - Conversely high vol stocks are expected to pay cash flows further in the future and are thus at the long end of the "equity yield curve" (not my term…)
    - Risk is composed of duration + interest rate vol, which decreases over time, making an even flatter frontier
  - Bernstein & Tew "The Equity Yield Curve" (1991)

# No, But Really… What's Going On? (Discussion)

- The Equity Risk Premium Puzzle was observed in the CAPM context:
  - Can we explain it by relaxing some of the assumptions / expanding the model?
  - To which extent was the CAPM framework abused by Equity Premium Puzzlers?

# Remedial Finance 101

- Sharpe (1964)
$$R_{i,t} = \alpha_i + \beta R_{m,t} + \varepsilon_{i,t}$$

- In practice, often simplified to:
$$R_{i,t} = \beta R_{m,t} + \alpha_{it}$$

- CAPM assumes that the error term is normally distributed and uncorrelated, e.g. the return on a stock goes up and down with the market to some extent, but that everything else is independent

# Multi Factor Models

- If the assumption re uncorrelated residuals were true there would be no Northfield as we know it.

- Clearly if the model is not fully specified, the shape of the Efficient Frontier will reflect this:
  - e.g. if the model were to contain a low vol vs high vol factor, as described in the aforementioned Blitz & Van Vliet (2007) (difference between top & bottom decile by vol) perhaps the Equity Premium Puzzle would be less puzzling.

# Extended CAPM Framework

- Explicitly accounting for the difference in returns between High & Low volatility Stocks could lead to a model like:

$$R_i = \beta R_{m,t} + \delta R_{volFMP} + \alpha_{i,t}$$

  Where RVolFMP is a factor modeling portfolio consisting of the top decile by vol minus the bottom decile by vol

# Does it work?

- Sandy Warrick's test…
  - S&P500 stocks, MVP using Northfield Fundamental model (incl. vol factor).
  - 1998 - 2007 Performance attribution using Northfield Fundamental model using Cap Weighted S&P as benchmark.
  - Total active return of .2 despite Beta of -.33.
  - Clearly accounting for vol explicitly does nothing to assuage the puzzle

# CAPM Abuse by Equity Premium Puzzlers

- Pop Quiz
  - What's the official CAPM Universe?
    - It it Equities?
    - Is it Equities + Bonds?
    - Is it Equities + Bonds + Commodities?
    - Is it the Entire Universe of liquid Securities?

# CAPM Investment Universe =

- Everything!

# Problem of Different Benchmarks

- One of CAPM's key assumptions is market transparency -- taking just a segment of the market is a violation of this assumption.
- If there are only Equities in the model:
  - The MVP will have significantly higher risk & return than than a corresponding MVP with Bonds.
  - The frontier will be much flatter.
- Introducing bonds to the universe, conversely will have the effect of increasing the marginal return per unit of risk.

# Different Benchmarks (cont…)

- An Equity portfolio manager's universe is the equity market;

- A CAPM investor's universe is the entire gamut of assets available in capital markets;

- CAPM was never intended for use with just a single asset class.

# Well, Maybe not Everything

- Fuhrman (2004) breaks bonds into:
  - Those that should be counted as different maturity risk-free assets;
  - Those that should be part of the market portfolio (corporate bonds);
  - And those that should not be double counted (e.g. securitized bonds, C__Os of all kinds).

# Fuhrman's Model

$$\beta = \frac{Cov(EqMkt, S)}{Var(EqMkt)}$$

$$\beta* = \frac{w*Cov(EqMkt, S) + (1-w*)Cov(r, S)}{w*Var(EqMkt) + (1-w*)Cov(r, EqMkt)}$$

- $\omega*$ = proportional weight of equity market in total market portfolio
- $S$ = given equity security
- $r$ = bond market
- $\beta*$ = equity beta adjusted to reflect whole market portfolio
- $\beta$ = beta relative to the equity market only
- $EqMkt$ = equity market only
- (presented at Newport 2004 – not entirely sure we agree with his algebra)

# Curious Results

|            | Equity B | Market B | % Diff  |
|------------|----------|----------|---------|
| Tech       | 1.452    | 1.35     | -7.55%  |
| Discr.     | .915     | .883     | -3.66%  |
| Materials  | .925     | .896     | -3.20%  |
| Health     | 1.193    | 1.186    | -.61%   |
| Indust.    | .988     | .983     | -.49%   |
| Energy     | .700     | .713     | 1.81%   |
| Telecom    | .846     | .872     | 2.96%   |
| Staples    | .759     | .784     | 3.16%   |
| Financial  | 1.107    | 1.161    | 4.69%   |

# Fuhrman Summarizes Fuhrman

- "In general, interest sensitive stocks will have total-market betas that are higher then their betas estimated by the equity markets alone."

# Topics for Empirical Study

- Test the extent to which the Equity Market Risk Premium persists when:
  - Vol is explicitly accounted for in the risk model;
  - Bonds are included in the investment universe.

# Conclusions

- There are many reasons, both Behavioral & Rational for the disproportionate risk adjusted returns of Equity  Market MVPs

- Two ways one could try to rationalize this behavior in an extended CAPM framework are:

  - Expanding the universe of securities;
  - Explicitly accounting for systematic risk due to volatility in the risk model

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