

The Equity Risk Premium, CAPM and Minimum Variance Portfolios

Northfield Information Services
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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)
- In practice, often simplified to:
- 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:

Where RVoIFMP 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?
 - Is 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 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

- ω^* = proportional weight of equity market in total market portfolio
- S = given equity security
- r = bond market
- β^* = equity beta adjusted to reflect whole market portfolio
- β = 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 than 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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