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**Market Returns without Downside Risk  
Or  
The Difference Between Beta and the  
Equity Premium**

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# Abstract

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Reproducing results from Haugen and Clarke et al, I find that minimum variance equity portfolios in the US and globally exhibit returns comparable to the returns of capitalization weighted portfolios. Following the standard textbook description of CAPM but using empirical data, one finds that the frontier corresponding to market clearing prices has been essentially flat; capitalization weighted portfolios (CWP) have added risk with little or no incremental return. In contrast, historical manager alpha forecasts lead to an efficient frontier dominating the market frontier. This demonstrates the inefficiency of the capitalization weighted portfolios.

To gain insight into the inefficiency, I analyze the implied alpha of the CWP using a performance attribution system, and find that the style and stock bets in CWP have no efficacy. Using quintile portfolios to test these implied alphas confirms the lack of efficacy. I interpret these findings to demonstrate that “cheap beta” does not efficiently realize the equity premium. Asset allocation frameworks frequently assume that capitalization weighted portfolios are effective proxies for the equity premium. The use of minimum variance portfolios as a more efficient proxy can markedly increase the target allocation to equities, and improve the returns of the overall plan.

Minimum variance portfolios represent a passive investment. Active alternatives further strengthen the case for portfolios managed relative to total risk. Various applications of leverage further improve on the expected returns.

I conclude with a discussion of the possible limitations of minimum variance portfolios, and specifically discuss trading and capacity limitations for these strategies. Due to the presence of investors with dramatically varying levels of assets, these effects are likely to be persistent.

# Outline

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- Exploring a client request
  - Return characteristics of systematic risk factors
  - CAPM and Minimum Variance Portfolios: theory, history and simulations
- Asset Allocation
- Active management relative to a cash benchmark
- Capacity limitations, persistence
- Why this is timely
- Concluding remarks

# Exploring a client request

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- A client requests a portfolio seeking equity market-like returns with limited downside risk
- Possible approaches:
  - Call options (downside risk is the premium)
  - Market Neutral (low absolute risk, high returns with good manager forecasts)
  - Long only equity but control (negative) fat tails
- Consider long only fully invested equity
  - Client seeks to market the product globally

## Some initial ideas to limit downside risk

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- Possible ways to improve portfolio skewness
  - Take advantage of factor return skewness, esp. country and risk factors
  - Large emerging market exposure
- Portfolio total risk scales the width of the probability distribution of returns
  - Low total volatility
- Incorporate alpha
  - To pay transaction costs
  - To compensate for downside

# Controlling Fat Tails

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- Moments of a probability distribution

$$\mu_n = E((X - \mu)^n)$$

- Dimensionless moments

$$\hat{\mu}_n = E\left(\left(\frac{X - \mu}{\sigma}\right)^n\right)$$

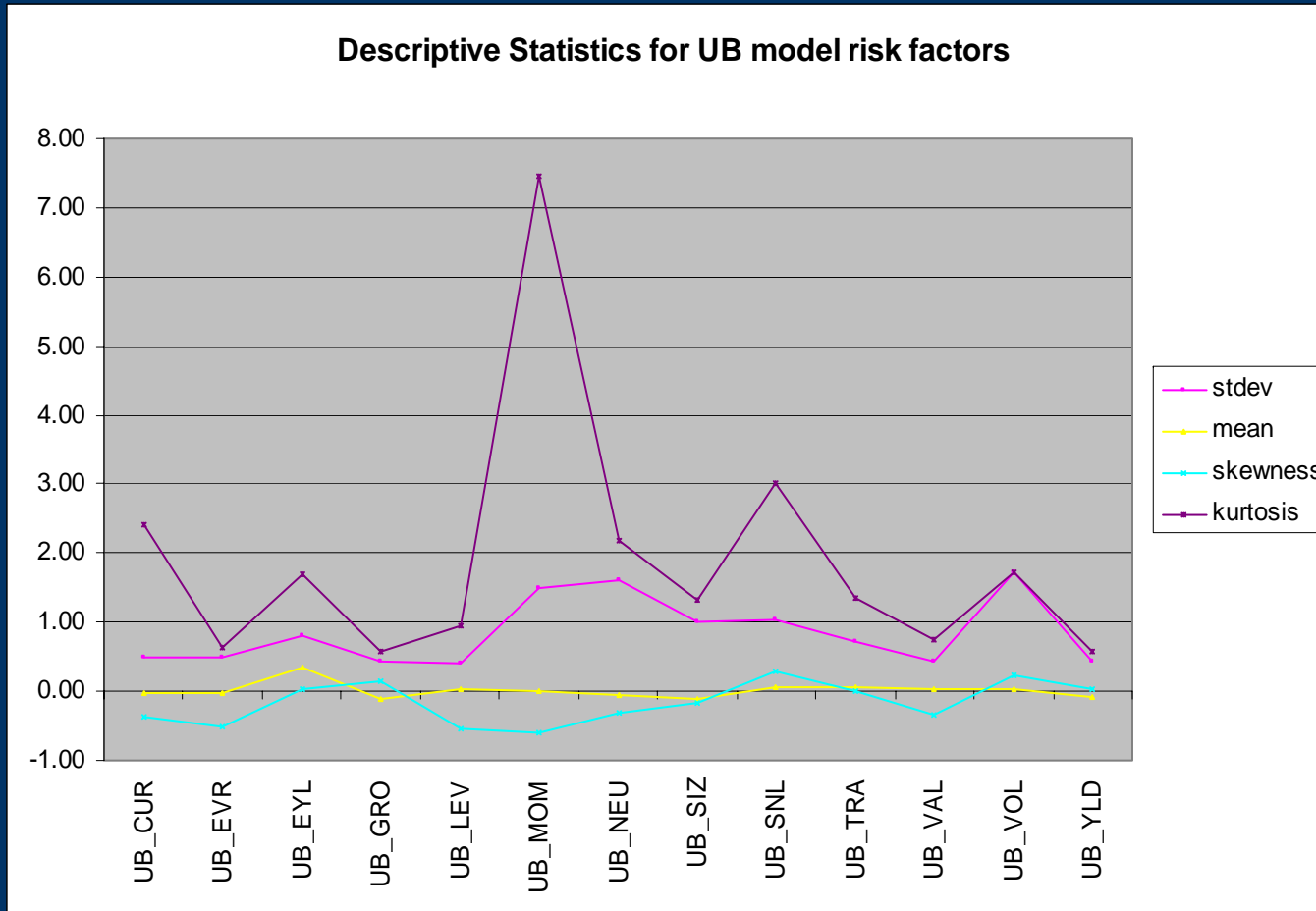
- Standard deviation  $\sigma$  sets scale of moments
- Skewness proportional to  $\sigma^3$
- Kurtosis proportional to  $\sigma^4$
- To control fat tails, can we control  $\sigma$ ?
- Recall Chebyshev:  $P(|X - \mu| > k\sigma) < k^{-2}$   
*Non-parametric*

## Factor returns - US model

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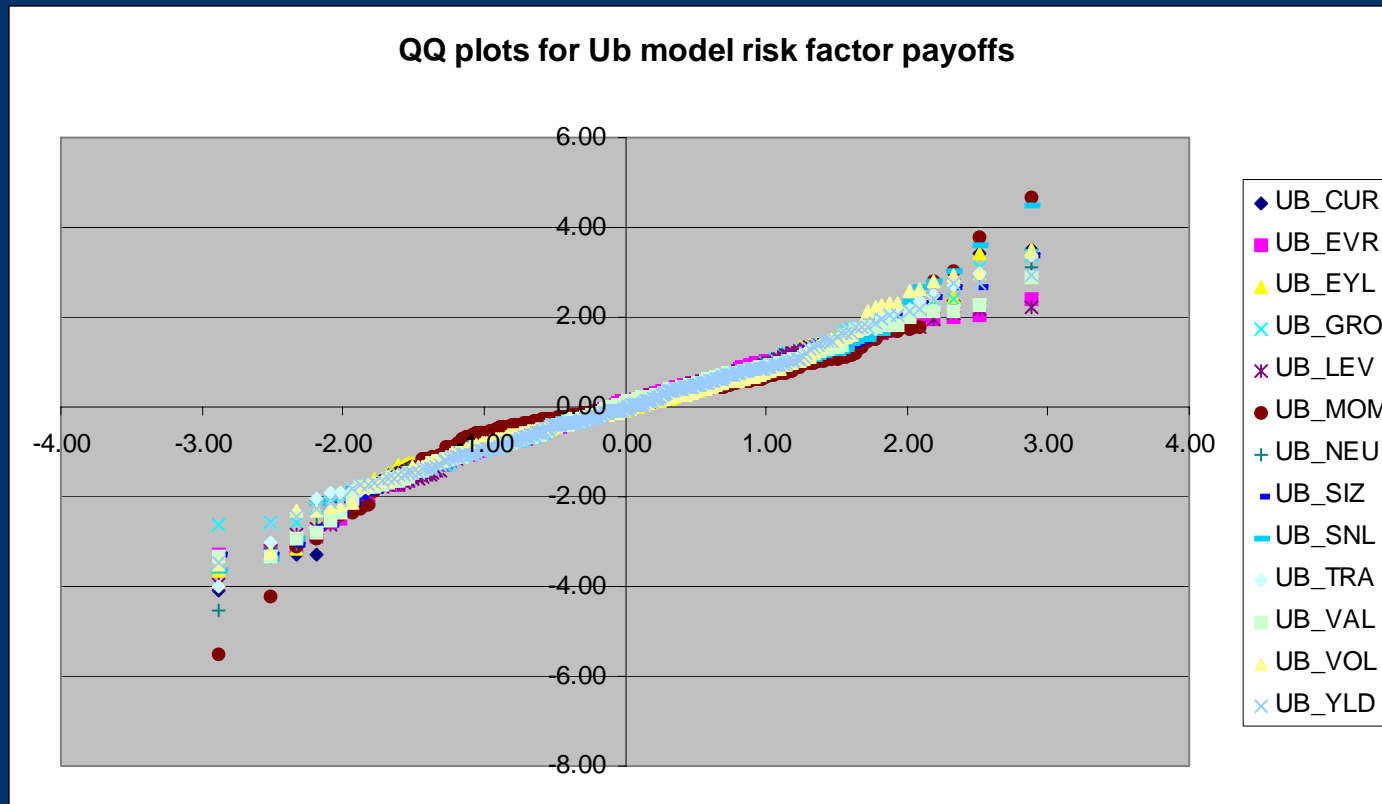
- Measure using performance attribution for unit exposure assets over entire model history (198611-200706)
- Factor skewness of both signs
  - >0: Growth, Earnings Yield, Volatility...
  - <0: Value, Size, Momentum, ...
- All factors have excess kurtosis

# Factor returns – US model



Source: underlying data from MSCI Barra

# Factor returns – US model

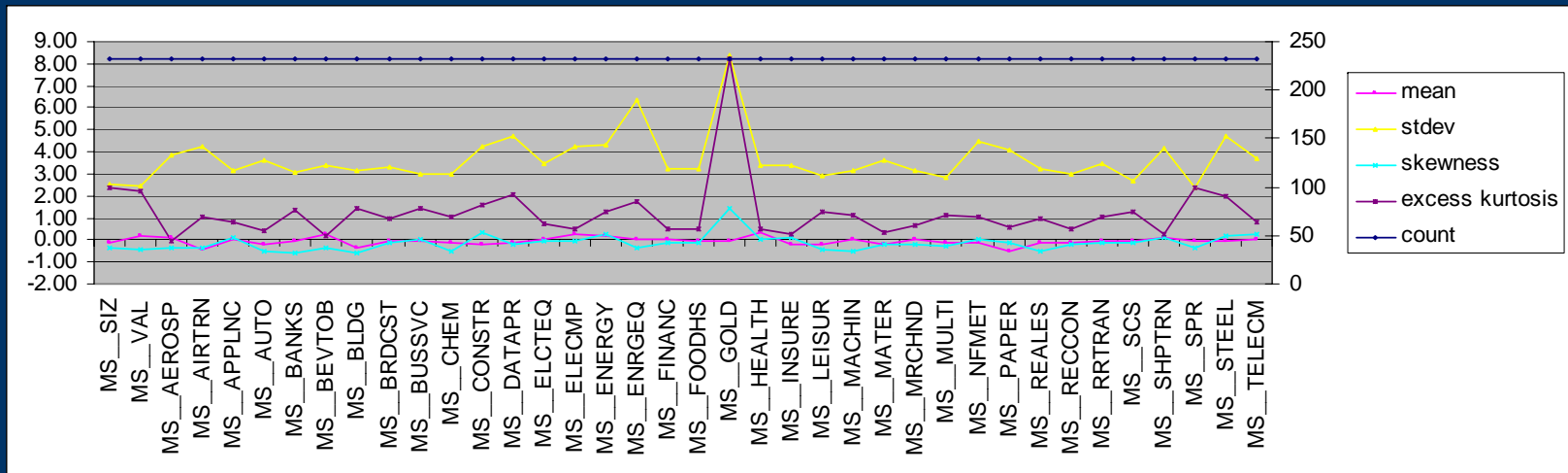
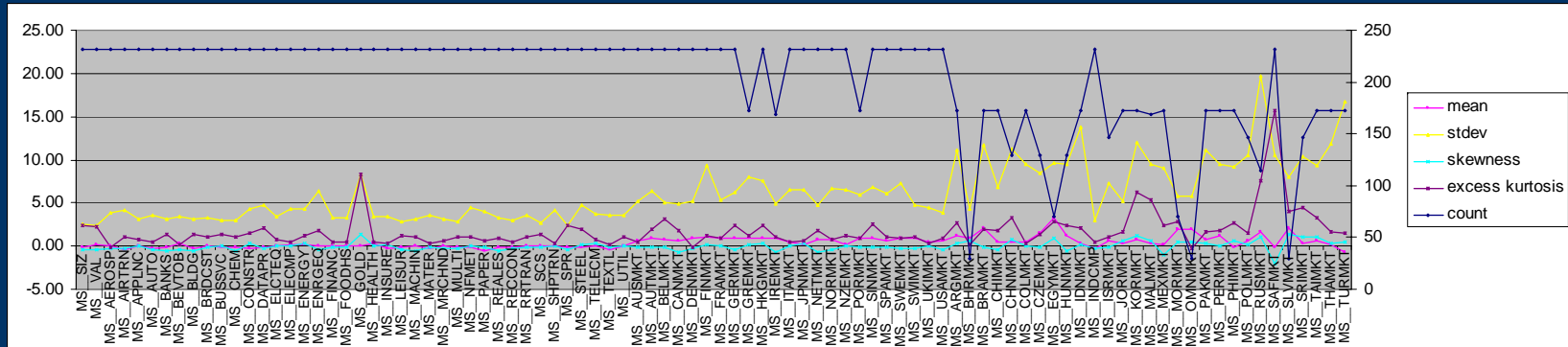


## Factor returns - Global model

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- Measure using performance attribution for unit exposure assets over entire model history (198802-200705)
- Factor skewness of both signs
  - >0: Growth, Earnings Yield, Volatility...
  - <0: Value, Size, Momentum, ...
- All factors have excess kurtosis

# Factor Returns – Global Model

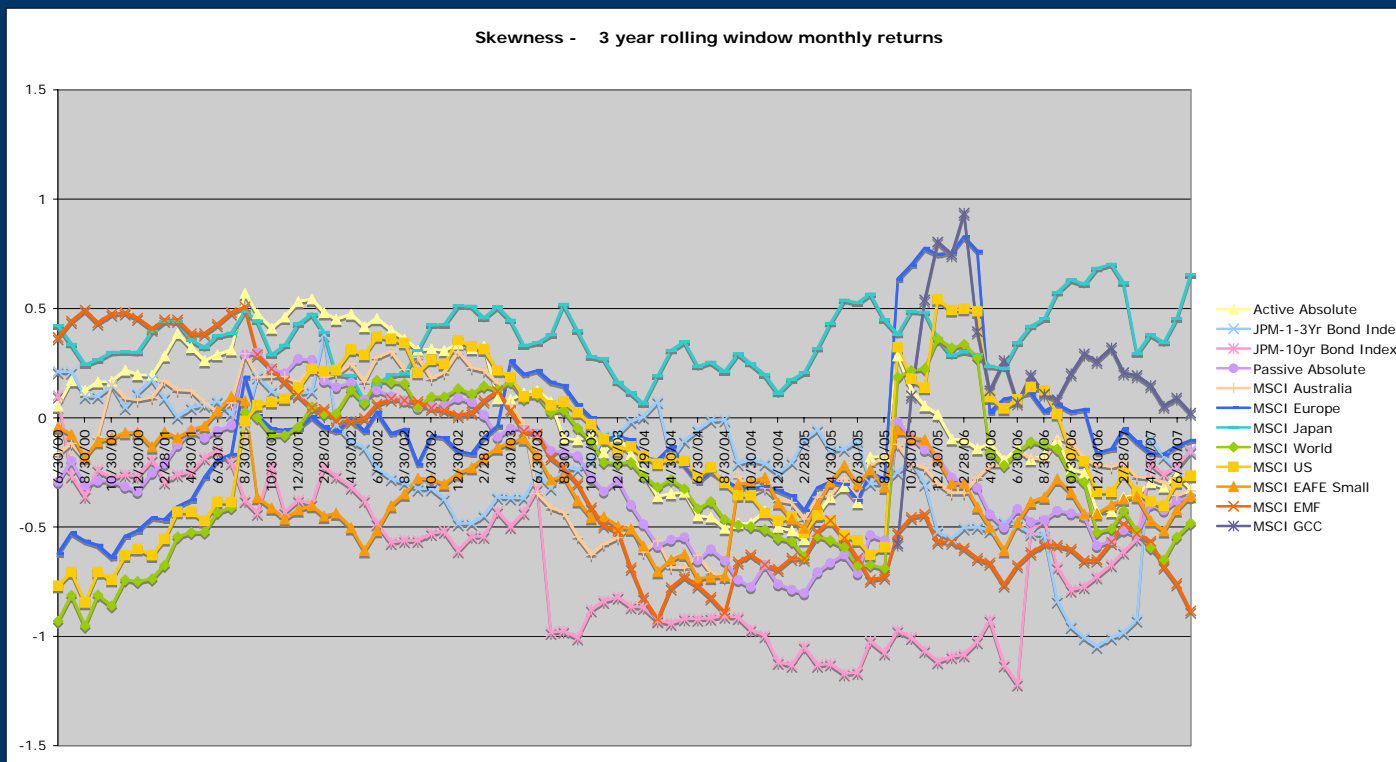


## Hard to Predict Higher Moments

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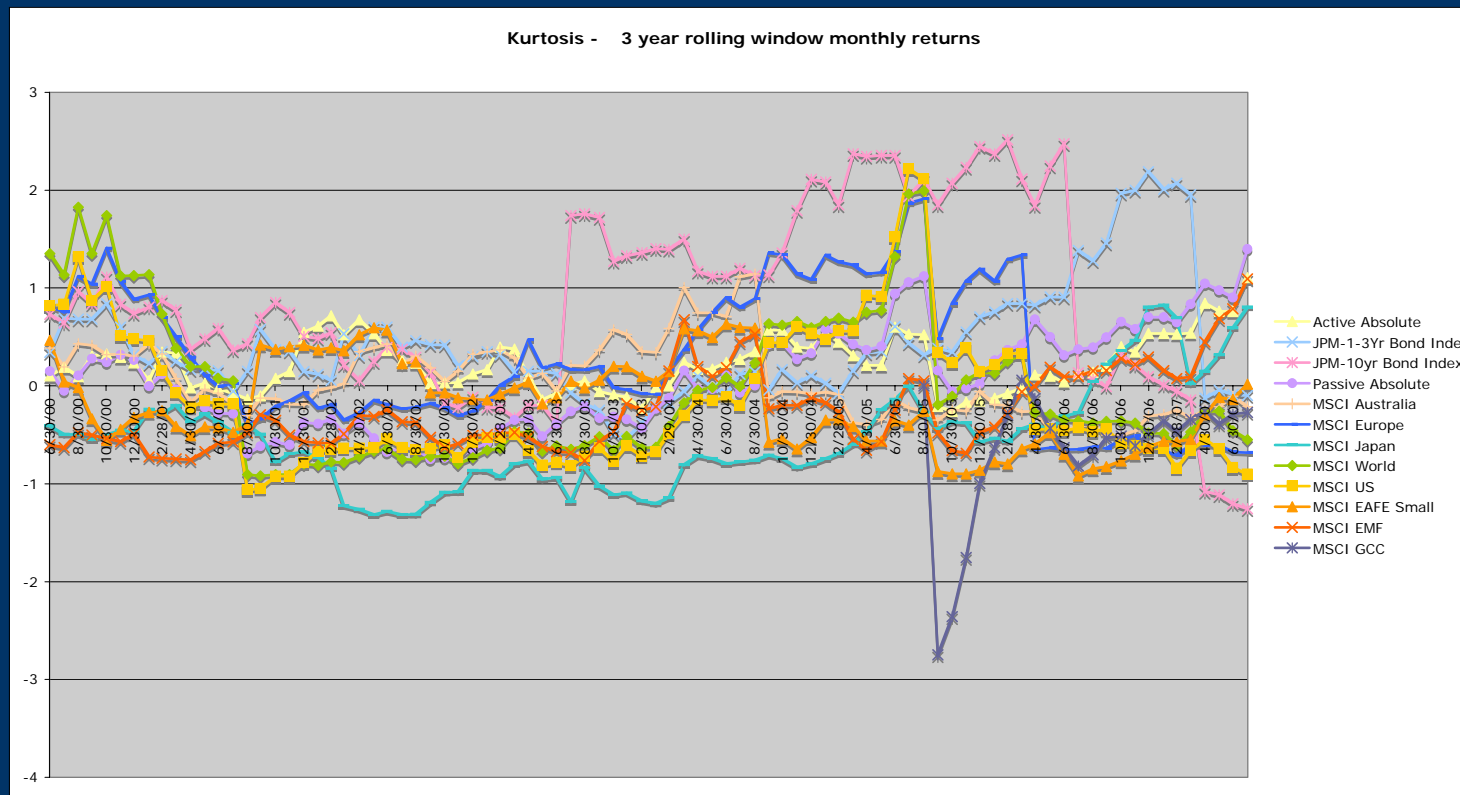
- Stationarity of factor returns suspect
  - Are any country returns actually thin tailed?
  - Time dependent coverage
- Stock returns often have non-stationary distributions - true even at the index level

# Higher Moments for Some Sample Indexes



Source: underlying data from MSCI Barra, JP Morgan, Acadian simulated portfolios

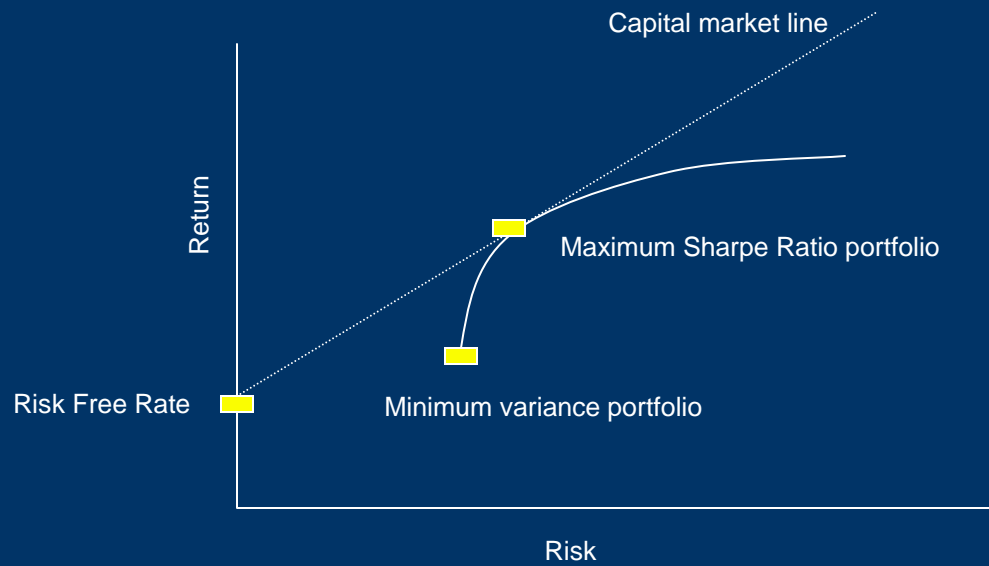
# Higher Moments for Some Sample Indexes



Source: underlying data from MSCI Barra, JP Morgan, Acadian simulated portfolios

# Review of CAPM

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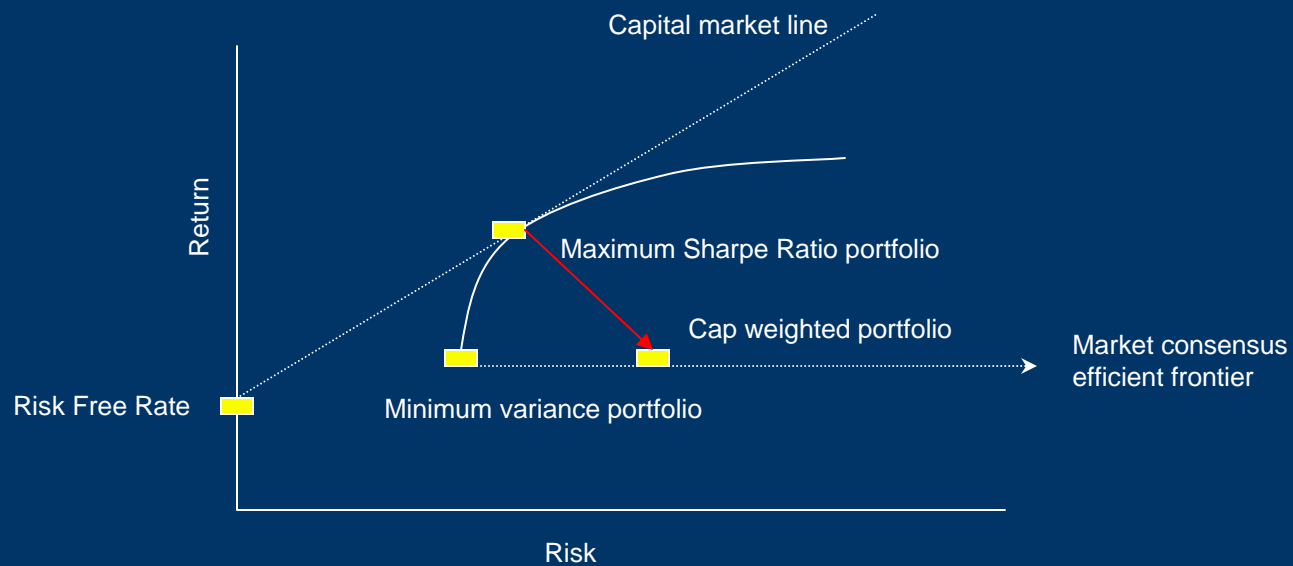


# Minimum Variance Portfolios in the context of CAPM

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- CAPM makes heroic assumptions (equilibrium, fully informed investors who agree, no taxes, borrowing and lending at the same risk-free rate, ...)
- Under CAPM, the Maximum Sharpe ratio portfolio is the market portfolio.
- CAPM has an efficient frontier (relative to the risk free asset)
- Assuming CAPM, minimum variance portfolio has lower return and Sharpe ratio than the market portfolio

# Empirical cash relative frontier



# Minimum Variance Portfolios (MVP)

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- Clarke et al.  
“Minimum-Variance Portfolios in the U.S. Equity Market” , Journal of Portfolio Management, Fall 2006
- Haugen and Baker  
“The Efficient Market Inefficiency Of Capitalization- Weighted Stock Portfolios”, Journal of Portfolio Management Spring 1991
- Acadian simulations confirm Clarke's findings for US, Australian and global portfolios. Global results illustrate the benefits of currency hedging for long term results.

# Performance attribution for cap weighted portfolios

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- Use minimum variance portfolio as the benchmark
- Neither style nor asset selection added value
- The benchmark to assess the cap weighted portfolio (CWP) and active manager portfolios should be the minimum variance portfolio.
- Manager frontier and market consensus frontier can differ, and can reveal manager skill (using CWP can obscure manager skill).

# Example performance attribution

## ATTRIBUTION REPORT

Annualized Contributions To Total Return Source of Return	Managed vs minimum variance		MSCI World vs minimum variance		Managed vs MSCI World	
	Contribution (% Return)	Risk (% Std Dev)	Contribution (% Return)	Risk (% Std Dev)	Contribution (% Return)	Risk (% Std Dev)
<b>1 Risk Free</b>	3.59	N/A	3.59	N/A	3.59	N/A
<b>2 Total Benchmark</b>	8.83	8.80	8.83	8.80	7.07	14.41
<b>3 Country Selection</b>	-0.52	1.94	-0.90	1.60	0.40	2.48
<b>4 Currency Selection</b>	0.60	1.21	0.69	1.39	-0.10	1.21
<b>5 Cash-Equity Policy</b>	-0.07	0.06	-0.09	0.11	0.00	0.00
<b>6 Asset Allocation [3+4+5]</b>	0.01	2.12	-0.30	2.06	0.31	2.71
<b>7 Local Market Timing</b>	0.53	1.84	1.70	8.14	-2.02	7.70
<b>8 Risk Indices</b>	1.42	1.21	-1.29	2.10	2.60	2.74
<b>9 Industries</b>	0.25	1.20	-0.09	1.70	0.54	2.01
<b>10 Asset Selection</b>	2.69	2.26	-1.72	1.87	5.15	1.93
<b>11 Within Market [7+8+9+10]</b>	4.88	3.30	-1.40	9.35	6.27	9.53
<b>12 Trading</b>	0.00	0.40	N/A	N/A	0.00	0.40
<b>13 Transaction Cost</b>	-1.24	N/A	N/A	N/A	-1.23	N/A
<b>14 Total Active [6+11+12+13]</b>	3.62	3.42	-1.76	9.41	5.38	9.45
<b>15 Total Managed [2+14]</b>	12.45	10.15	7.07	14.41	12.45	10.15

Source: Acadian simulated performance

## Efficacy of implied alpha

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- Extract implied alpha for a cap weighted benchmark
- Use implied alphas to construct quintile portfolios to measure spreads
- The market consensus offers negligible forecast value (no free lunch).

## Beta $\neq$ Equity Premium

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- Minimum variance portfolio is fully invested and captures the equity premium
- Beta relative to the cap weighted portfolio adds uncompensated risk
- Better market proxy (missing assets)?
  - Capitalization would have to be enormous to change the result

# Simplified Asset Allocation Framework

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- Select some investible proxies for asset classes of interest
  - JPMorgan 1-3 year bond index
  - JPMorgan 10 year bond index
  - MSCI indexes (World, AU, JP, US, Europe, EAFE Small cap, EMF)
  - Passive and active absolute return portfolios

## Simplified Asset Allocation Framework (2)

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- Assume long only allocations
- Use historical covariance
- Optimize allocations using historical returns and forecast returns
  - Historical data provides a reference to place the covariance data in context
  - Forecast data seeks to avoid the rear view mirror

# Asset Allocation Methods

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- Compute covariance from monthly returns (in Excel)
- Use Solver to optimize mean variance returns at varying levels of risk aversion

- U is utility

$$U = \sum_k R_k w_k - \lambda \sum_{k,k'} w_k \Gamma_{kk'} w_{k'}$$

- $w_k$  is weight of  $k^{\text{th}}$  asset

- $R_k$  is return of  $k^{\text{th}}$  asset

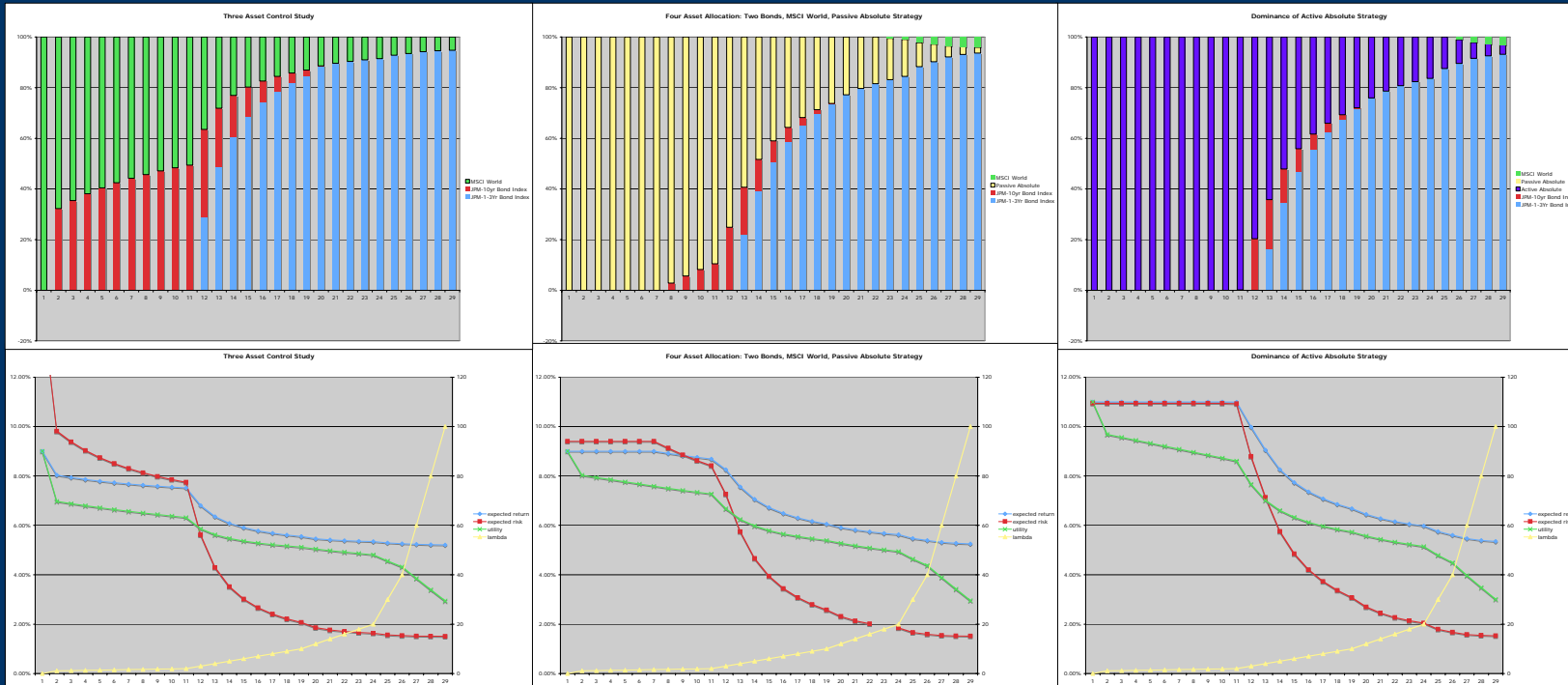
- $\Gamma_{kk'}$  is covariance of  $k^{\text{th}}$  and  $k'^{\text{th}}$  assets

# Historical Correlations

	JPM-1-3Yr Bond Index	JPM-10yr Bond Index	MSCI EMF	MSCI Japan	MSCI Australia	MSCI US	MSCI Europe	MSCI EAFE Small	MSCI World	Passive Absolute	Active Absolute
JPM-1-3Yr Bond Index	100%	71%	-32%	-16%	-18%	-30%	-30%	-24%	-32%	-16%	-19%
JPM-10yr Bond Index	71%	100%	-23%	-13%	-12%	-22%	-21%	-7%	-23%	-6%	-6%
MSCI EMF	-32%	-23%	100%	55%	73%	70%	70%	77%	77%	58%	55%
MSCI Japan	-16%	-13%	55%	100%	60%	47%	45%	73%	61%	65%	61%
MSCI Australia	-18%	-12%	73%	60%	100%	64%	67%	75%	74%	71%	66%
MSCI US	-30%	-22%	70%	47%	64%	100%	81%	58%	96%	70%	70%
MSCI Europe	-30%	-21%	70%	45%	67%	81%	100%	68%	92%	75%	70%
MSCI EAFE Small	-24%	-7%	77%	73%	75%	58%	68%	100%	71%	77%	72%
MSCI World	-32%	-23%	77%	61%	74%	96%	92%	71%	100%	80%	77%
Passive Absolute	-16%	-6%	58%	65%	71%	70%	75%	77%	80%	100%	95%
Active Absolute	-19%	-6%	55%	61%	66%	70%	70%	72%	77%	95%	100%
Historical Returns	4.5%	7.7%	16.9%	2.9%	11.3%	6.2%	9.2%	13.7%	6.3%	6.4%	11.4%
Historical Risk	1.7%	8.7%	21.9%	20.2%	18.4%	15.8%	16.7%	15.8%	15.0%	9.4%	11.0%
Forecast Returns	5%	6%	14%	6%	10%	8%	9%	14%	9%	9%	11%

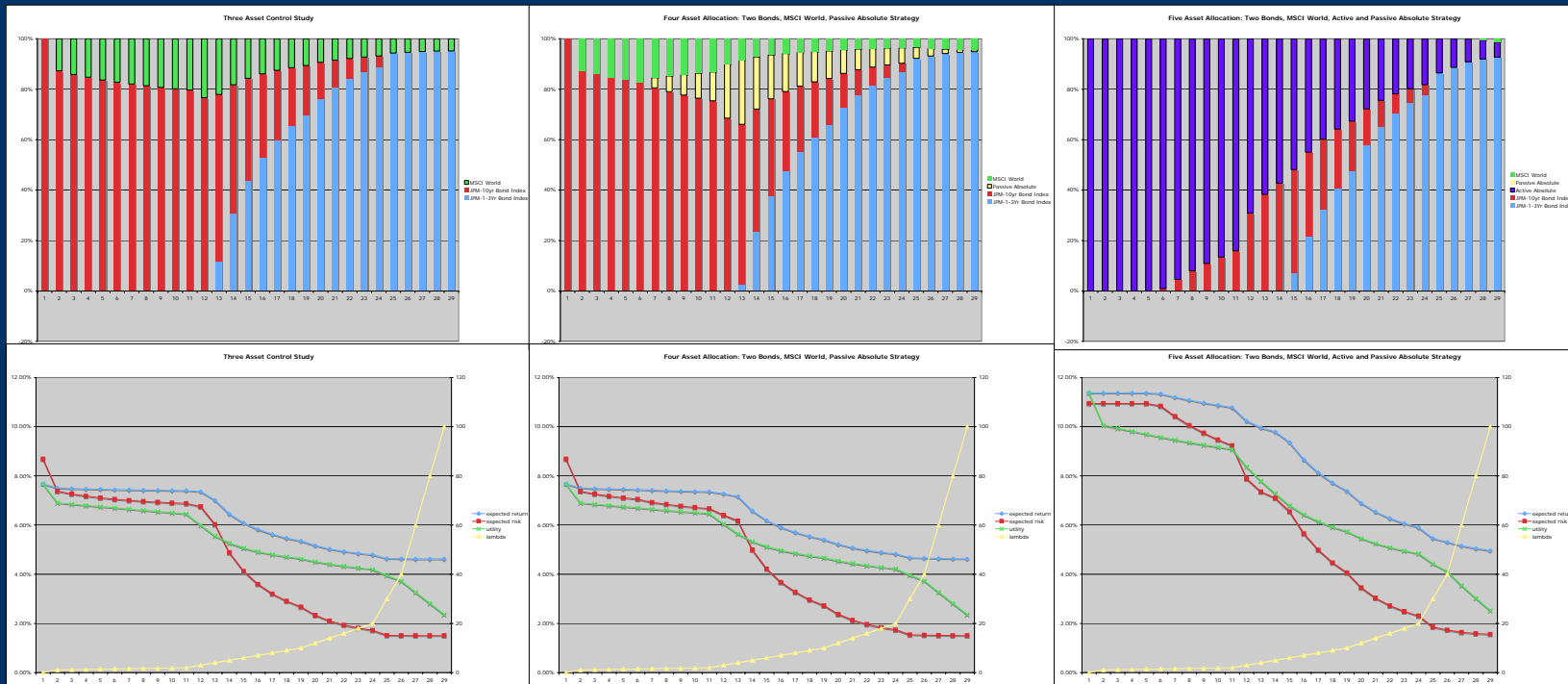
Source: underlying data from MSCI Barra, JP Morgan, Acadian simulated portfolios

# Allocation Results using Forecast Returns



Source: underlying data from MSCI Barra, JP Morgan, Acadian simulated portfolios

# Allocation Results using Historical Returns



Source: underlying data from MSCI Barra, JP Morgan, Acadian simulated portfolios

# Impact of Minimum Variance Portfolios on Asset Allocation

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- The addition of minimum variance portfolios to the standard asset allocation framework increases the equity contribution to both risk and return
- Domination of the cap weighted equity proxy by absolute return portfolios highlights the difference between beta and the equity premium
- Material improvements in overall plan returns possible

# Active Management Relative to a Cash Benchmark

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- Describe capacity limitations
- Describe turnover
- Describe the noise trader argument for likely persistence of the effects
- Describe how the persistence of beta versus equity premium relates to long term market disequilibrium

## Limitations of minimum variance portfolios

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- Capacity limitations  
*As assets become large, cap weights are the only investment available*
- High tracking error when viewed from a conventional viewpoint
- Relatively high turnover  
*(typically over 10% per month)*

# Capacity considerations

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- Underlying experiments need to be completed

# Persistence of capitalization weighted benchmark portfolios

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- Could be due to noise trading
  - Advances in Behavioral Finance, Thaler Ch.2
  - Cap weighting easy to implement
  - Huge percentage of market assets managed to cap weighted benchmark
  - Material risk for arbitrageurs

# Role of shorting in active management relative to a cash benchmark

Annualized Contributions To Total Return		US strategy					
Source of Return	Russell 1000	Russell 3000	Minimum Variance	long only 60bp limit	long only 100bp limit	130/30 100bp limit	
<b>1 Risk Free</b>	3.53	3.53	3.53	3.53	3.53	3.53	3.53
<b>2 Total Benchmark</b>	7.14	7.14	7.14	7.14	7.14	7.14	7.14
<b>3 Expected Active</b>	-0.02	0.00	-3.47	-2.94	-3.10	-3.85	-3.85
<b>4 Market Timing</b>	-0.05	0.00	2.22	2.29	2.37	2.44	2.44
<b>5 Risk Indices</b>	-0.32	0.00	3.55	4.01	4.00	5.31	5.31
<b>6 Industries</b>	0.00	0.00	0.21	-0.29	-0.31	-0.35	-0.35
<b>7 Asset Selection</b>	0.30	0.00	0.83	2.01	2.67	3.77	3.77
<b>8 Trading</b>	N/A	N/A	N/A	N/A	N/A	N/A	N/A
<b>9 Transaction Cost</b>	N/A	N/A	N/A	N/A	N/A	N/A	N/A
<b>10 Total Exceptional Active[4+...+9]</b>	-0.07	0.00	6.81	8.02	8.73	11.17	11.17
<b>11 Total Active [3+10]</b>	-0.09	0.00	3.34	5.09	5.63	7.32	7.32
<b>12 Total Managed [2+11]</b>	7.05	7.14	10.48	12.23	12.77	14.45	14.45

Source: underlying data from MSCI Barra, JP Morgan, Acadian simulated portfolios

## Why is this timely

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- 20 years ago, even US transactions costs were high, ~100bp
- Commercial risk models available since 1980's, but supporting tools for portfolio construction and trading both expensive and weak
- Today, direct market access available in most developed markets
- The bloom is off the rose for cap weighted benchmarks; active investing well established

## Outlook and conclusions

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- Absolute return portfolios may be exiting the pioneering phase and moving into rapid growth
- Increased attention to liability driven investment (LDI) and stability of pension plan funding status may lead to demand for more efficient investments

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