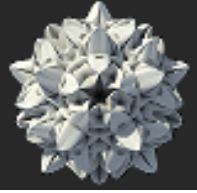

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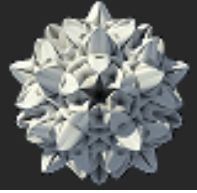
Advisors

An Old, New Idea

Louis Scott

LQG Autumn 2014

A Simple Idea



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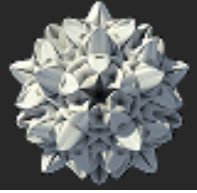
The Problem Pension long term return assumptions of 8 percent or even higher to estimate their actuarial liability.

The Idea Find sets of assets that have the property of co-integration relative to the return assumption as a fixed benchmark.

Deviations mean-revert Motivated by economic equilibrium theories linking assets prices or expected returns to fundamentals.

Set Up



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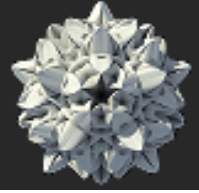
- MSCI developed equities (USD, Gross)
- Jan 1970 to July 2014
- Target of World + 7%
- Stock and Watson 1988 and diBartolomeo 1999
- Optimize every 4 years, quarterly rebalance, expanding window
- Adding a few objectives

Multiple Objective Optimization



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$$minf(\omega) \approxeq \left\{ \begin{array}{c} -\text{Co-integration Prob(w)} \\ \text{Surplus(w)} \\ \text{turnover(w)} * \mathbb{I}_{[\text{turnover(w)} \geq 40\%]} \end{array} \right\}$$

s.t.

$$0 \leq w_i \leq (.75, .5, .25)$$

$$\Sigma w = 1$$

$$.7 \leq (\beta * w) \leq 1.3$$

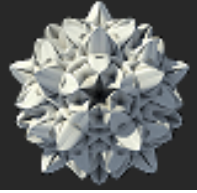
$$\Sigma \mathbb{I}_{[w \geq .05]} > 7$$

where

$$resids = w^{\intercal} * P - \text{Liab}$$

$$Surplus = resids^{\intercal} * resids / Liab^{\intercal} * Liab$$

Multi Objective Genetic Algos



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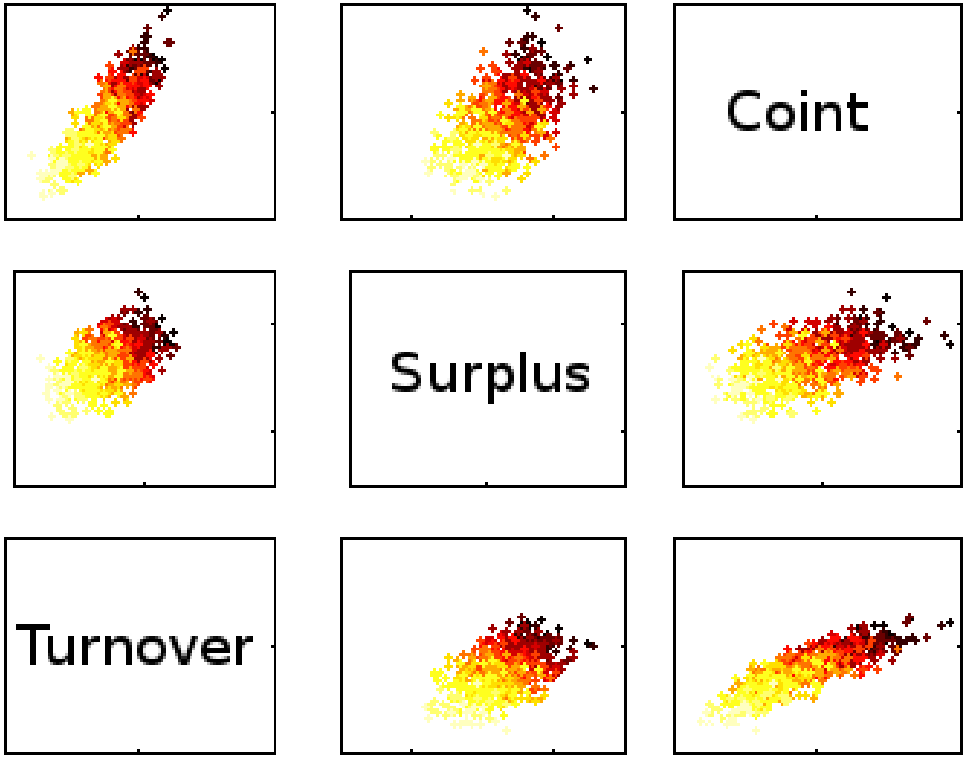
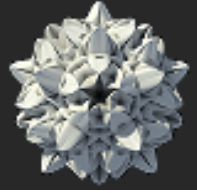
- Generate a Pareto Optimal frontier.



Portfolio on Dec 1989

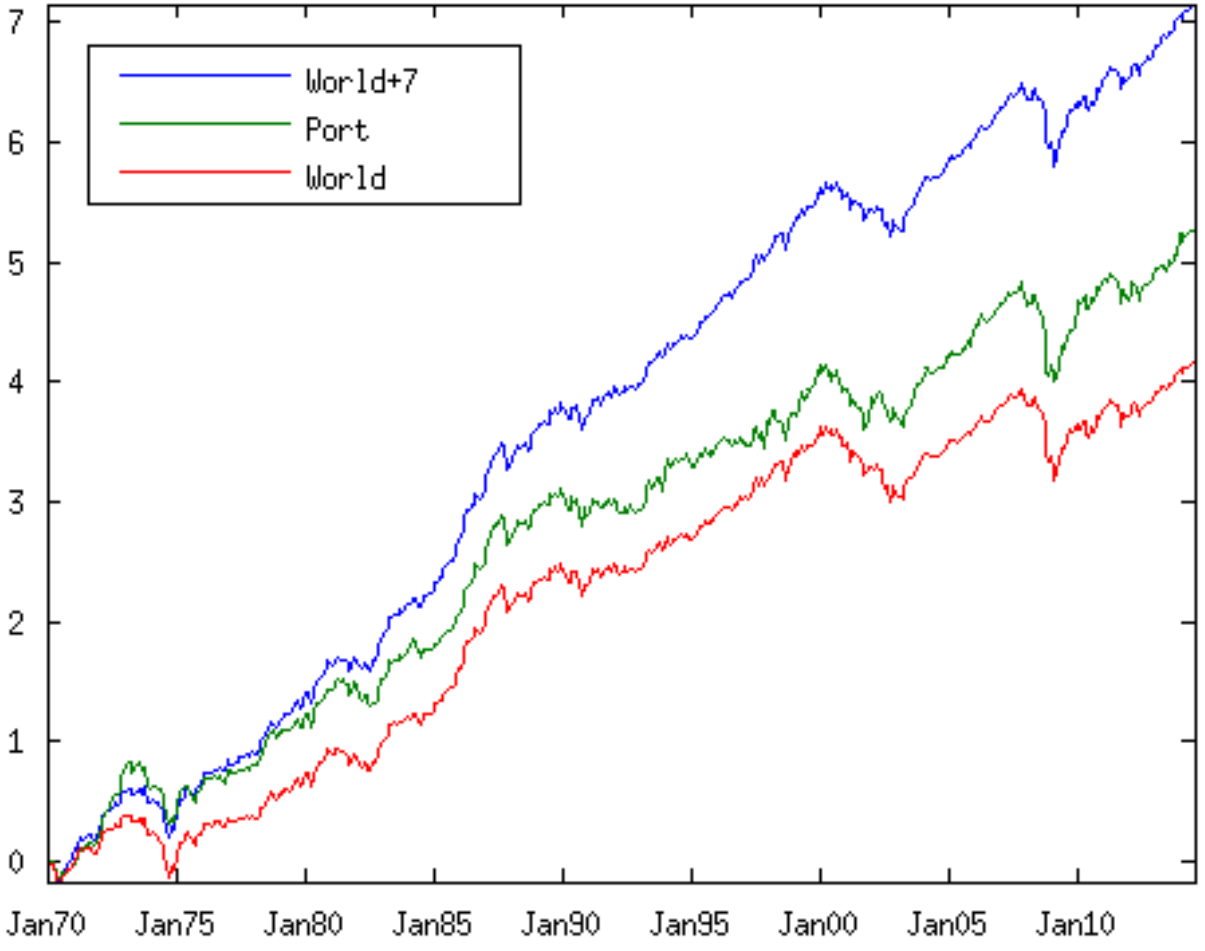


Kiema Advisors

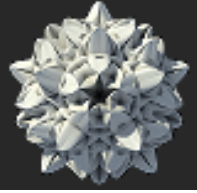
	wts	mkt	credit	indpro	slope	smb
JAPAN	0.253	0.948	-2.340	1.487	0.514	-0.204
USA	0.159	0.949	1.058	-0.517	-0.021	0.139
WORLDexUSA	0.116	1.035	-1.471	0.354	-0.339	-0.142
SINGAPORE	0.100	1.159	-3.884	0.006	-0.267	-0.246
PACIFIC	0.091	0.995	-2.044	1.264	-0.371	-0.196
CANADA	0.085	1.018	-1.316	-0.501	-3.304	-0.081
SWEDEN	0.063	0.766	-0.393	-0.997	-0.704	-0.094
WORLD	0.063	1.000	-0.000	0.000	0.000	-0.000
NETHERLANDS	0.031	0.992	-2.722	-0.401	1.032	-0.115
UK	0.016	1.294	1.418	-0.810	-1.054	-0.137
Exposures	1	1.004	-1.465	0.358	-0.265	-0.116
$XSec_\sigma$	0.065	0.212	1.733	1.054	1.827	0.129

Table : Portfolio Wts and Betas

Obligatory LQG chart



Portfolio on Dec 2009

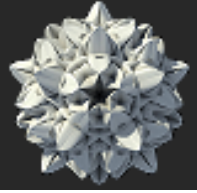


Kiema Advisors

	wts	mkt	credit	slope	smb	indpro
HONGKONG	0.220	1.155	-3.120	-1.111	-0.265	0.412
JAPAN	0.211	1.013	-0.508	-0.207	-0.106	0.047
SWEDEN	0.181	1.071	-2.360	-2.550	-0.129	-0.565
BELGIUM	0.121	0.932	-6.249	1.810	-0.168	-0.554
NETHERLANDS	0.104	1.011	-3.956	0.882	-0.101	-0.316
WORLDexUSA	0.066	1.061	-1.526	-0.341	-0.109	-0.088
UK	0.056	1.093	-0.246	-0.021	-0.102	-0.318
EAFE	0.020	1.043	-1.306	-0.257	-0.120	-0.135
SINGAPORE	0.017	1.153	-4.942	-0.235	-0.168	0.146
FRANCE	0.009	1.095	-1.276	-1.531	-0.205	-0.469
Exposures	1	1.078	-2.636	-0.482	-0.155	-0.128
$XSec_\sigma$	0.072	0.119	2.268	1.325	0.090	0.290

Table : Portfolio Wts and Betas

Normalized Exposures

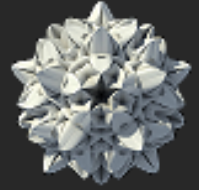


Kiema Advisors

	1989	**1993**	**1997**	**2001**	**2005**	**2009**	**2013**
mkt	1.004	1.061	1.086	1.094	1.058	1.078	1.064
hml	1.106	1.310	1.320	1.072	1.023	0.657	0.698
smb	2.467	1.785	1.853	1.774	1.769	1.463	1.388
mom	0.436	-0.131	0.364	-1.083	-0.825	-0.519	-1.341
ltr	-0.607	-1.212	-0.696	-0.423	-0.649	0.090	0.079
credit	-1.870	-1.410	-1.241	-1.152	-1.139	-0.411	-0.191
indpro	1.440	1.647	1.076	1.134	1.124	0.277	0.955
slope	1.782	2.015	1.847	1.817	2.312	1.784	1.162

Table : Portfolio Exposures

Results Full Sample

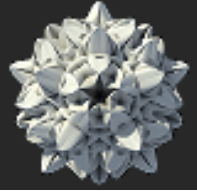


Kiema Advisors

31-Dec-1969 to 31-Jul-2014
$R^2 = 0.7271, \bar{R}^2 = 0.7229, \sigma^2 = 0.0008$
Durbin-Watson 2.1456 , (Nobs, Nvars) $(534, 9)$
annualized Alpha: 3.04

variable	Coeff	t-stat	t-prob
const	0.002534	**2.068**	0.039
WORLD	1.074456	**34.592**	0.000
HML	-0.117181	**-2.251**	0.024
SMB	-0.142353	**-3.002**	0.002
MOM	0.004200	0.144	0.885
LTR	0.161108	**2.687**	0.007
Cred	-2.598261	**-2.441**	0.014
IP	-0.115500	-0.451	0.652
Slope	-0.127070	-0.166	0.867

Results Out of Sample

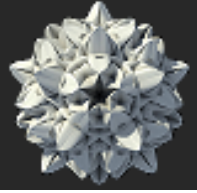


Kiema Advisors

29-Dec-1989 to 31-Jul-2014
$R^2 = 0.6809, \bar{R}^2 = 0.6720, \sigma^2 = 0.0013$
Durbin-Watson 2.169 , (Nobs, Nvars) $(295, 9)$
annualized Alpha: 2.182

variable	Coeff	t-stat	t-prob
const	0.001818	0.857	0.391
WORLD	1.145898	**21.525**	0.000
HML	-0.202181	**-2.383**	0.017
SMB	-0.189765	**-2.326**	0.020
MOM	0.009567	0.219	0.826
LTR	0.243743	**2.302**	0.022
Cred	-3.402299	-1.641	0.101
IP	-0.358242	-0.975	0.329
Slope	-0.162474	-0.095	0.924

Results Crisis and after

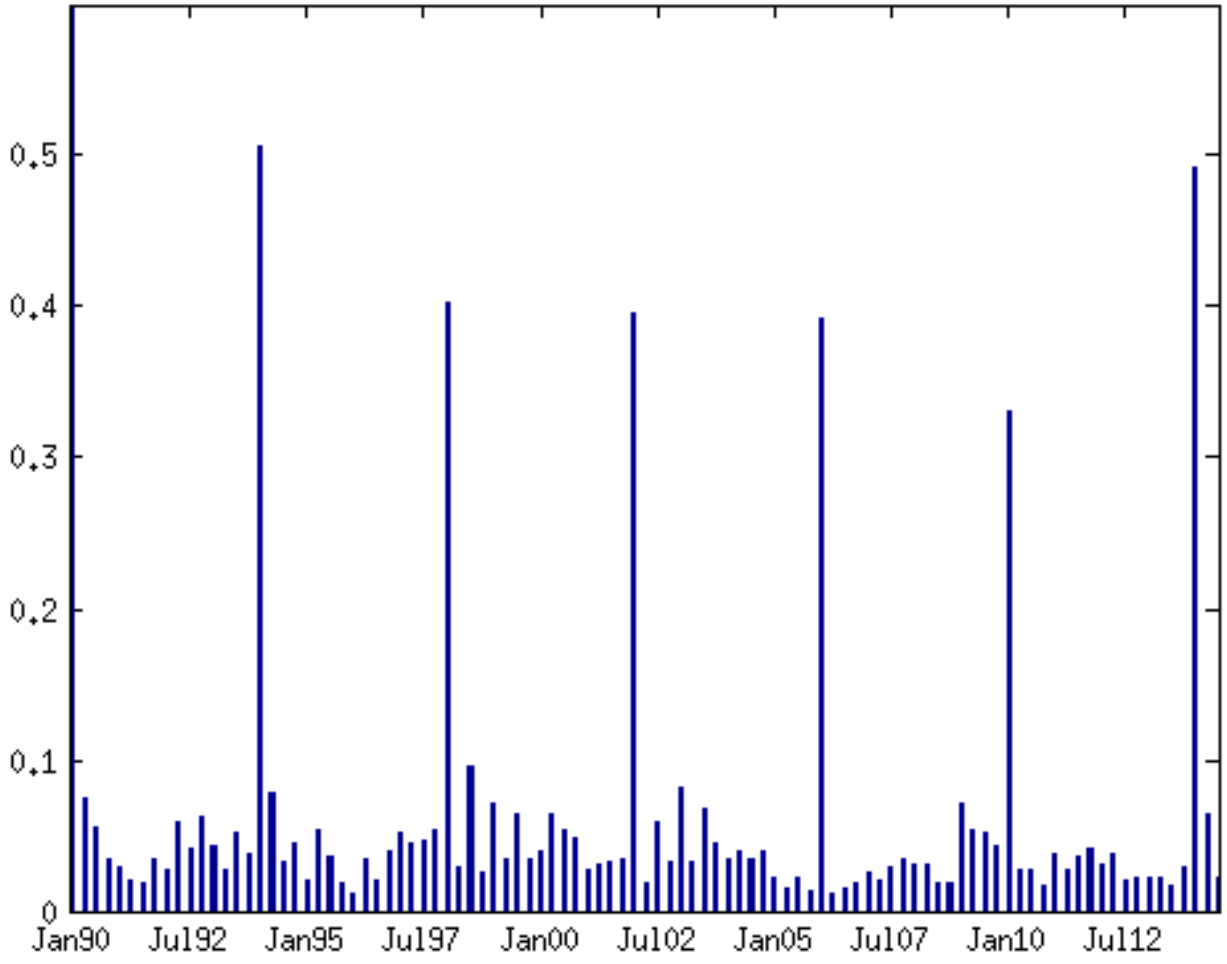


Kiema Advisors

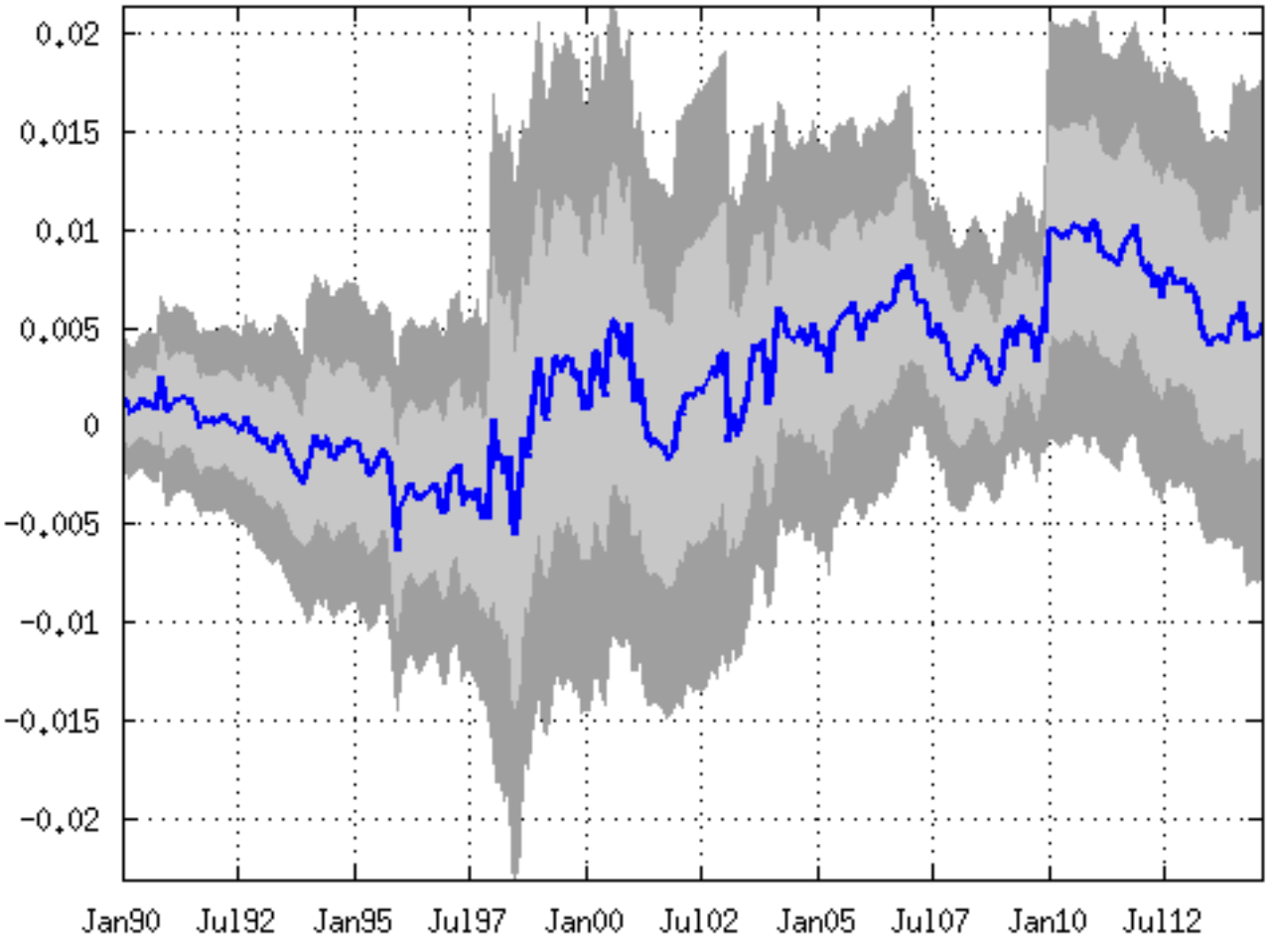
Post Crisis: 31-Jan-2007 to 31-Jul-2014
$R^2 = 0.7842, \bar{R}^2 = 0.7626, \sigma^2 = 0.0012$
Durbin-Watson 2.10 , (Nobs, Nvars) $(89, 9)$
annualized Alpha: 6.9942

variable	Coeff	t-stat	t-prob
const	0.005829	1.517	0.133
WORLD	1.092282	**10.716**	0.000
HML	-0.733416	**-3.332**	0.001
SMB	-0.369407	**-1.970**	0.052
MOM	-0.084969	-1.112	0.269
LTR	0.680555	**3.269**	0.001
Cred	-6.702638	**-2.365**	0.020
IP	-0.102626	-0.214	0.830
Slope	-5.624491	**-2.125**	0.036

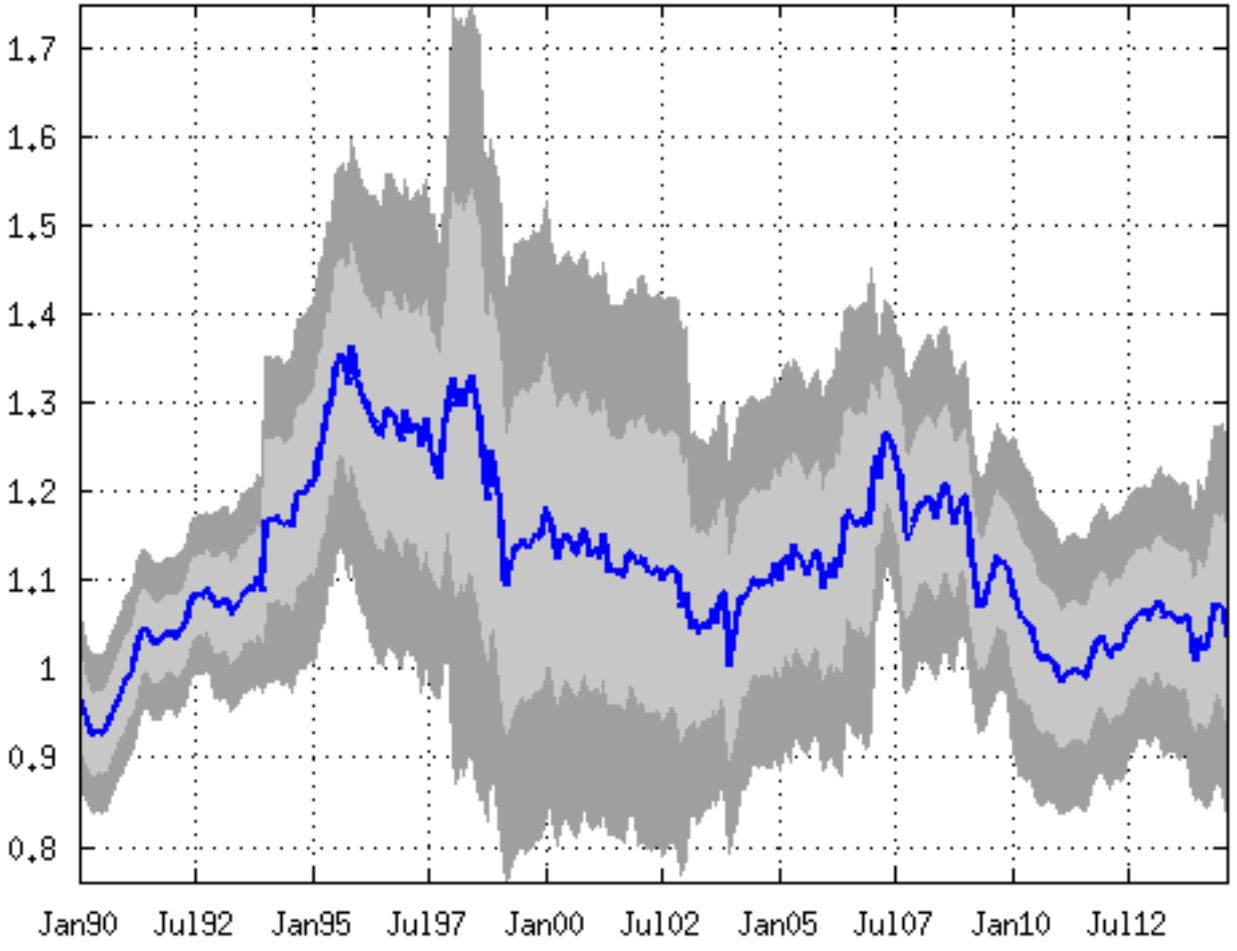
Turnover


0.5
0.4
0.3
0.2
0.1
0
Jan90
Jul92
Jan95
Jul97
Jan00
Jul02
Jan05
Jul07
Jan10
Jul12

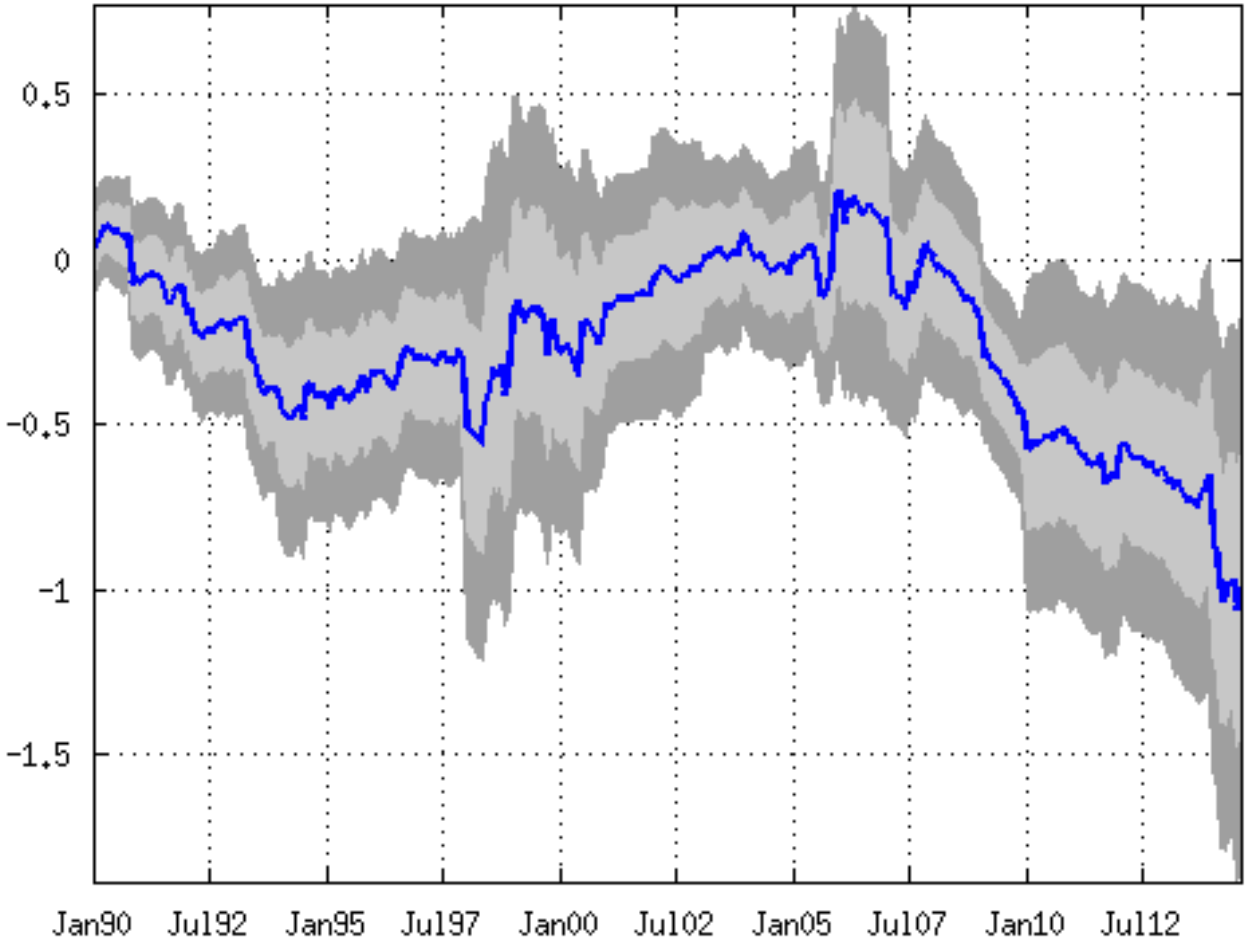
Factor Exposures: Rolling 5 yr α



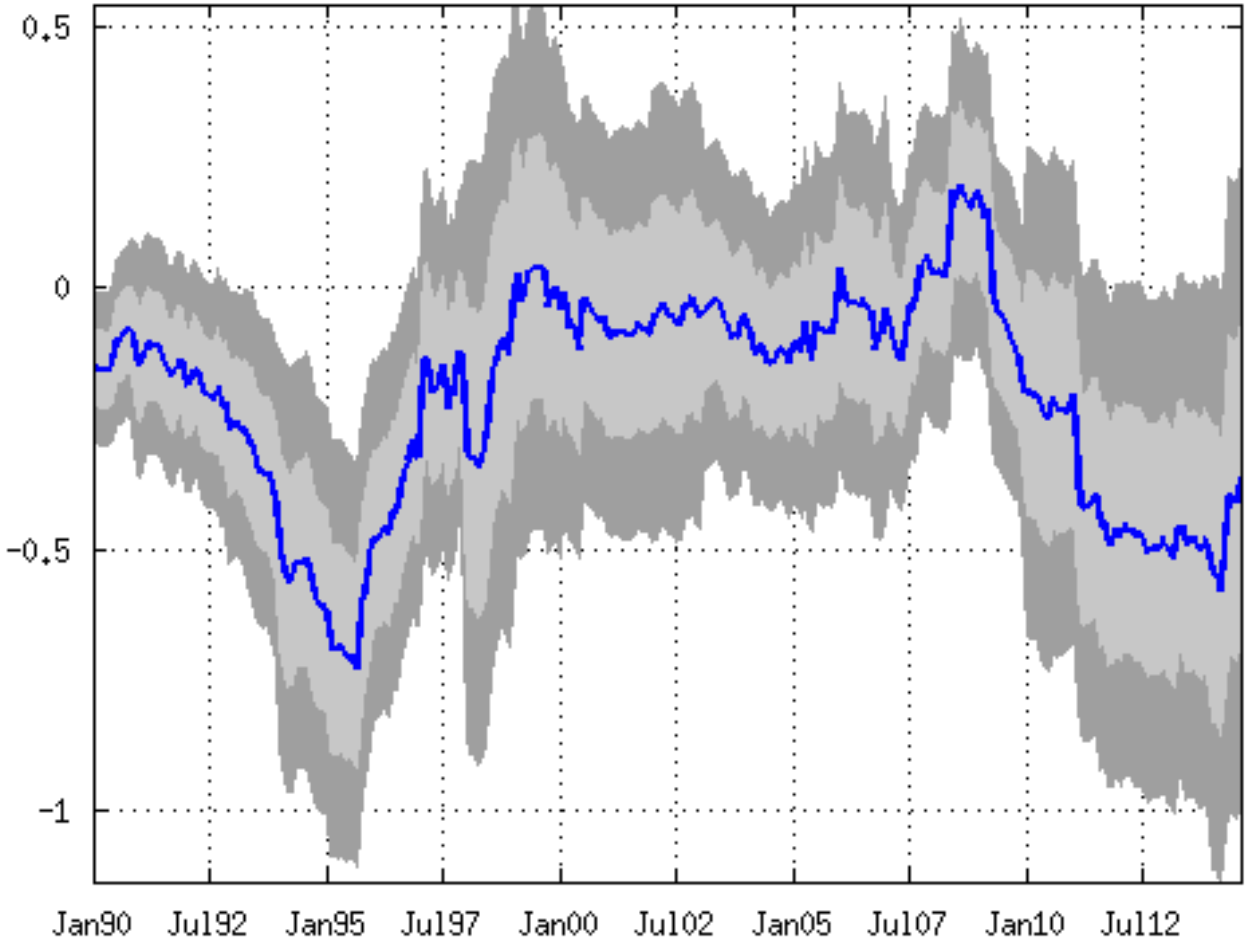
Factor Exposures β



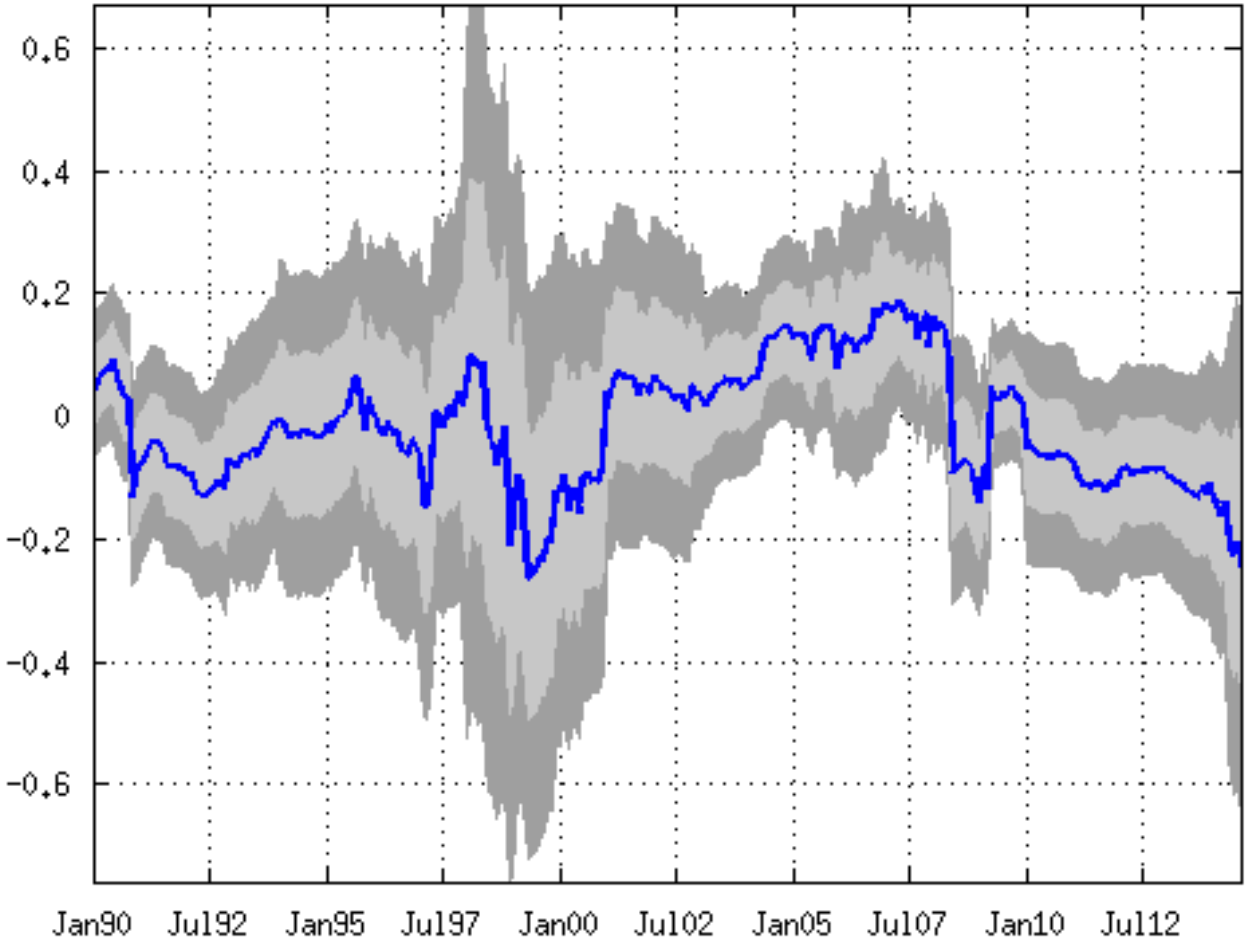
Factor Exposures HML



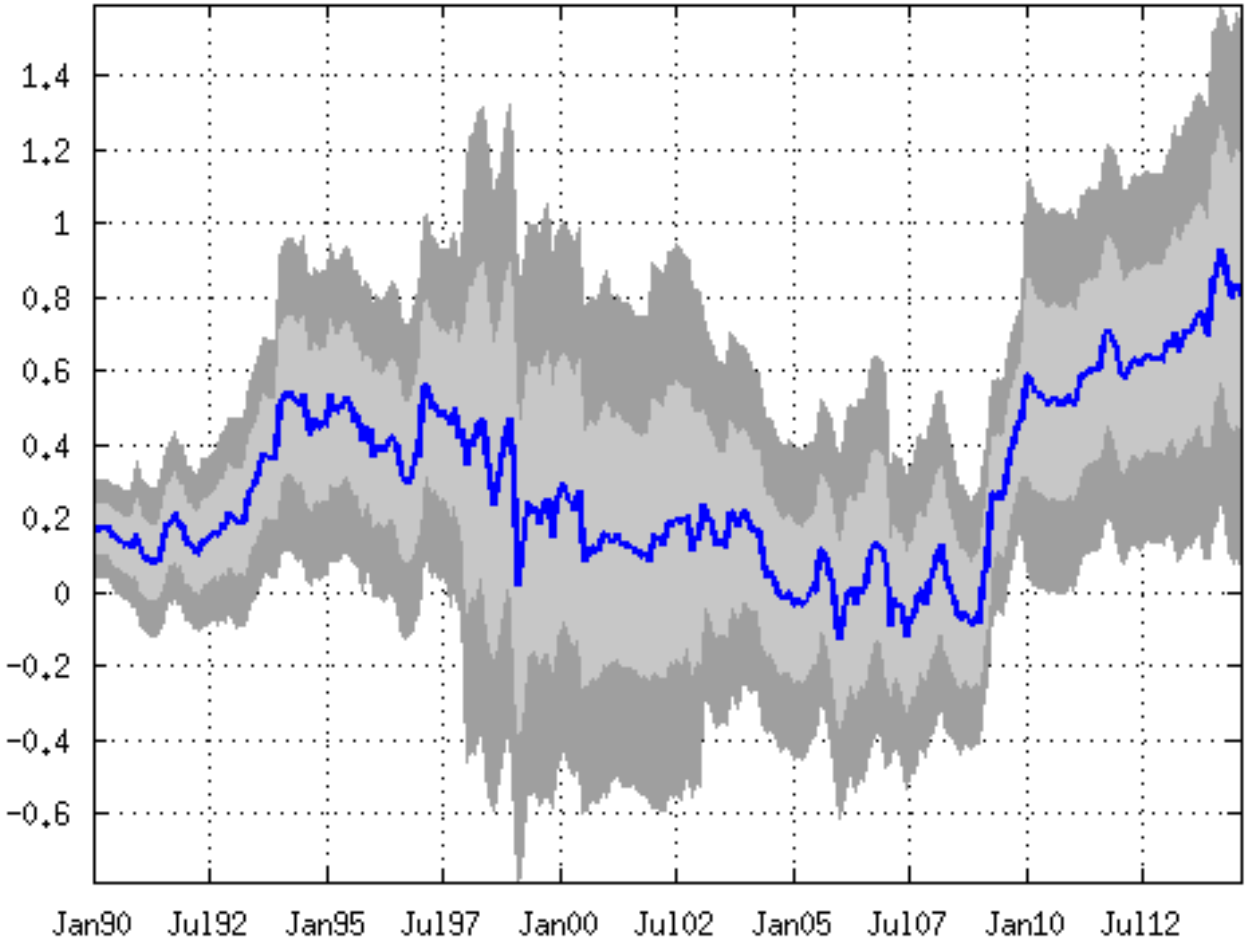
Factor Exposures SMB



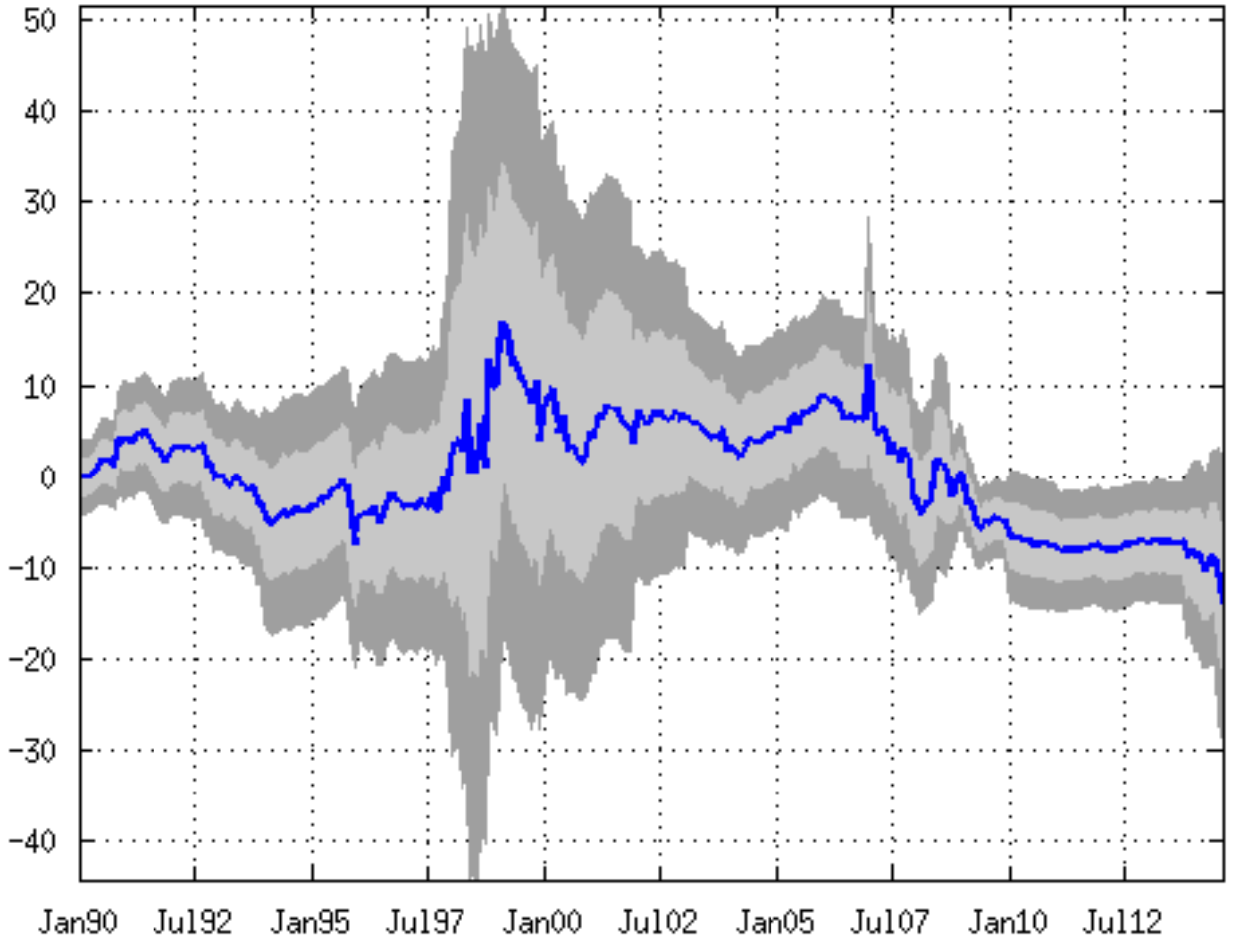
Factor Exposures MOM



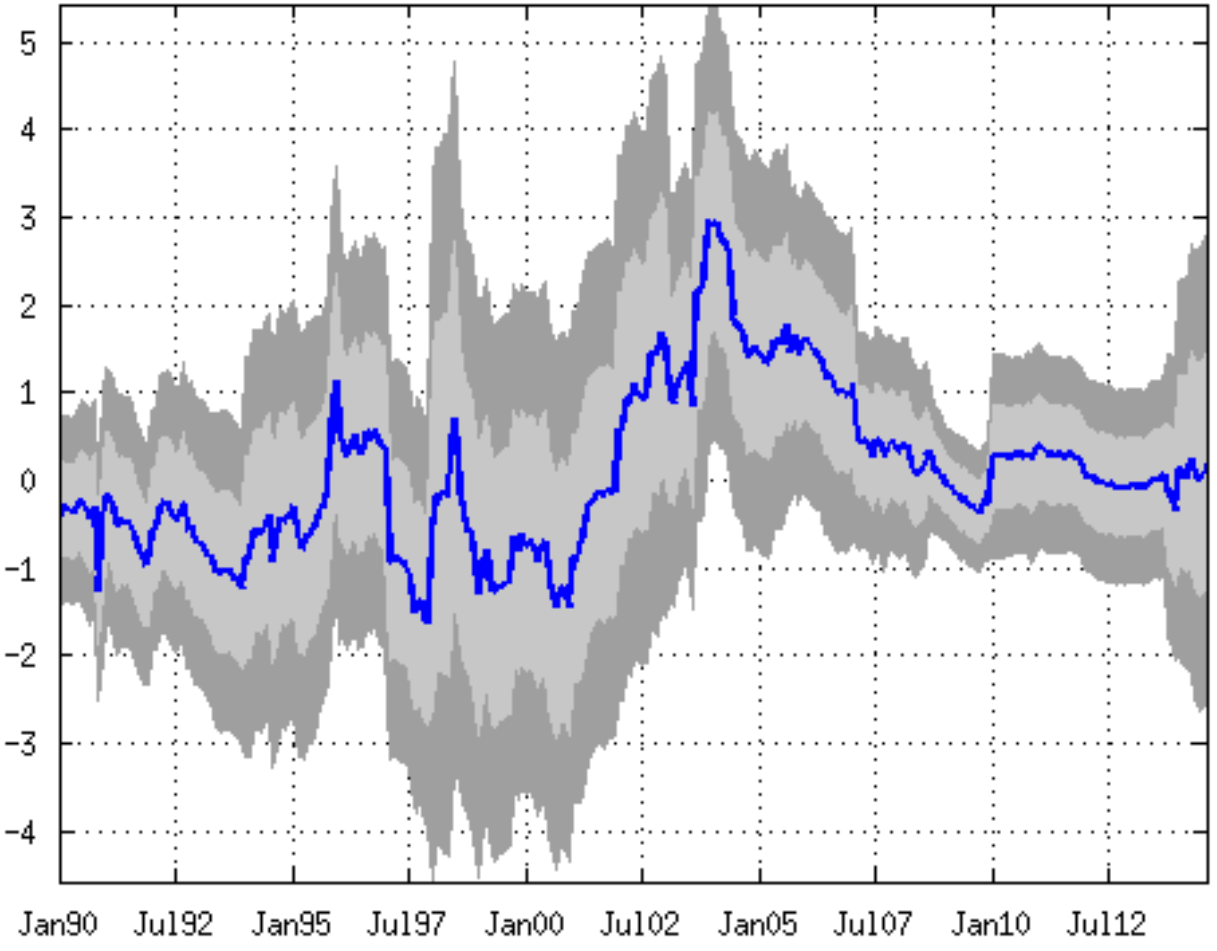
Factor Exposures LTR



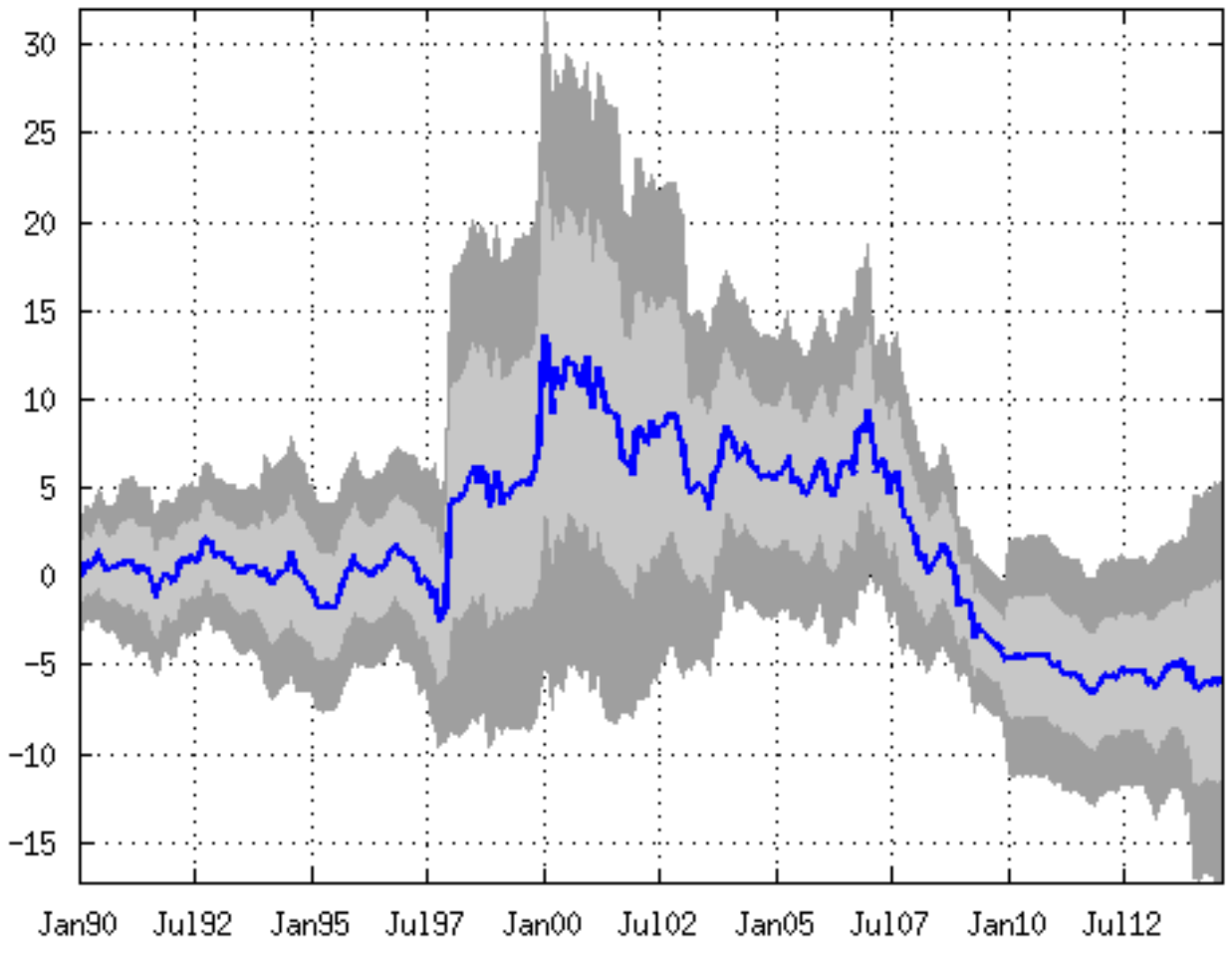
Factor Exposures Credit



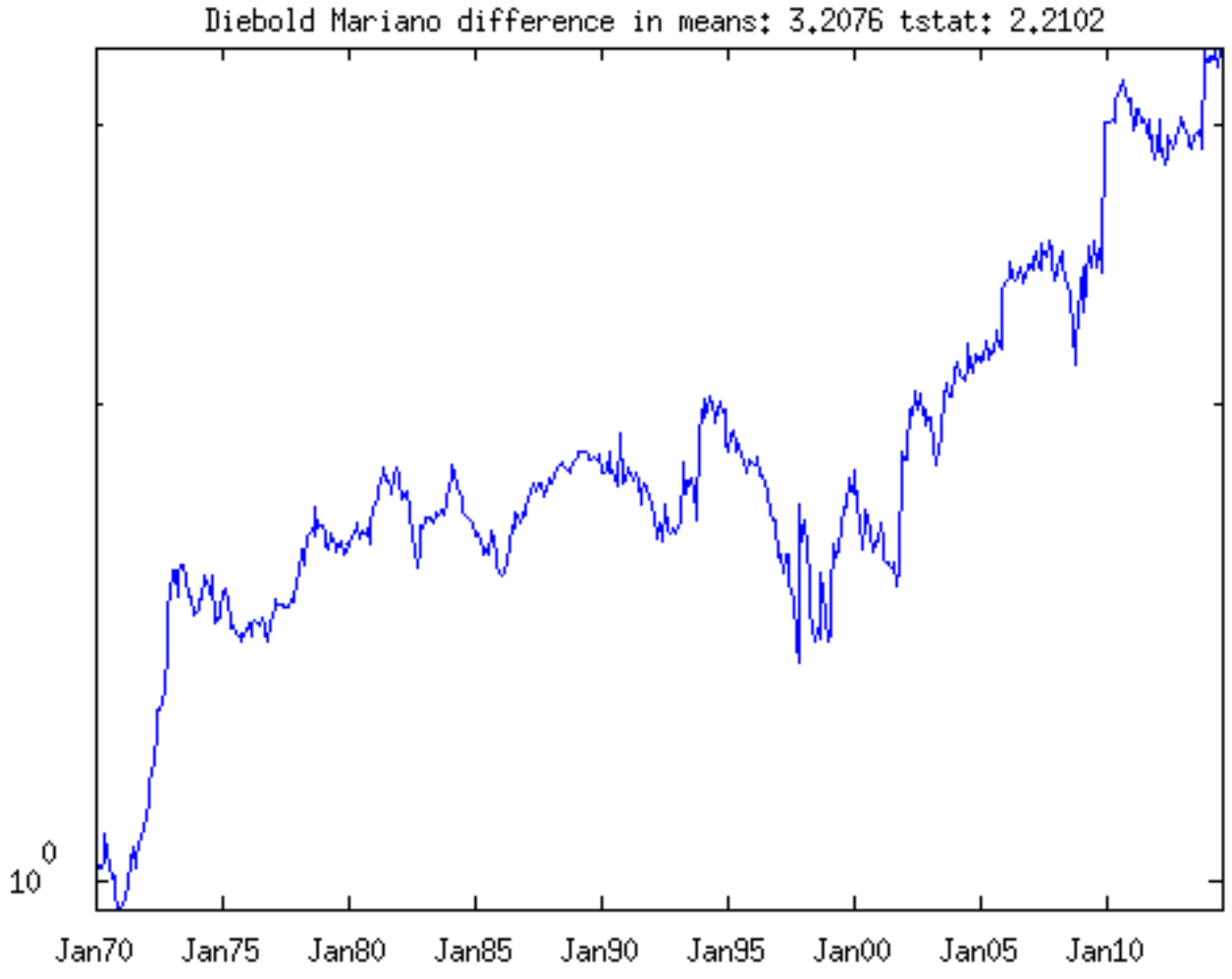
Factor Exposures Ind Prod



Factor Exposures Term Slope

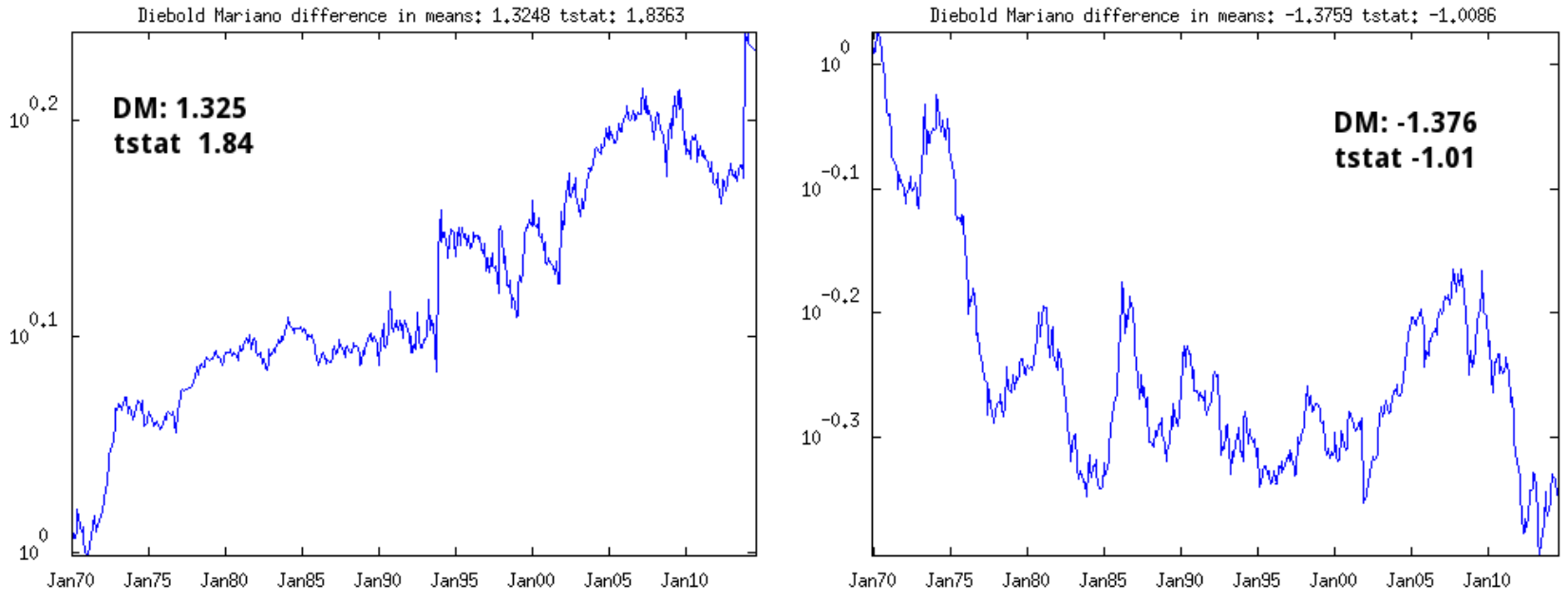


Relative to the WORLD



Diebold Mariano Diff in Means 3.2% t-stat 2.2

What if



(a) World + 3%

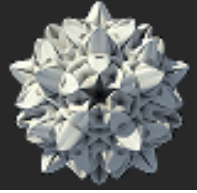
(b) World - 7%

Figure : Two alternate drift targets

Parting Thoughts

- Cointegrating relationship
- Market plus premia tilts
- Flexible optimization
- No convergence results

Portfolio on Dec 2013



Kiema Advisors

	wts	mkt	credit	slope	indpro	smb
HONGKONG	0.246	1.130	-3.342	-1.431	0.216	-0.258
SWEDEN	0.186	1.109	-2.776	-2.269	-0.687	-0.147
NETHERLANDS	0.114	1.031	-4.076	0.943	-0.485	-0.105
BELGIUM	0.107	0.938	-6.120	1.595	-0.608	-0.176
JAPAN	0.098	0.974	-0.019	-0.301	0.278	-0.097
SINGAPORE	0.073	1.133	-4.714	-0.711	0.053	-0.179
WORLDexUSA	0.068	1.063	-1.630	-0.372	-0.129	-0.109
EAFE	0.038	1.048	-1.450	-0.252	-0.179	-0.121
FRANCE	0.031	1.125	-1.861	-1.193	-0.656	-0.210
SWITZERLAND	0.023	0.886	-1.590	2.743	-0.138	-0.050
Exposures	1	1.064	-3.107	-0.591	-0.209	-0.166
$XSec_\sigma$	0.067	0.104	2.375	1.303	0.315	0.090

Table : Portfolio Wts and Betas

- Campbell J. and Shiller R. (2001) Valuation Ratios and the Long-Run Stock Market Outlook: An Update.
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