Generalized Momentum Asset Allocation using MSCI indexes

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Agenda

- Introduction
- Methodology and data set
- Results
- Conclusions
- Extensions

Introduction

- Asset Allocation based on time-series momentum is a strategy that tries to exploit a momentum anomaly between various assets. It uses various moving averages/momentum filters to gain an exposure to an asset class only at the time when there is a higher probability for outperformance with less risk.
- This strategy has emerged form the papers of the Noblists: **Markowitz**, "Portfolio Selection", 1952 and **Fama&Franch** „Common risk factors in the returns on stocks and bonds", 1983 and has been popularized by **Faber** in „Relative Strength Strategies for Investing", 2010.

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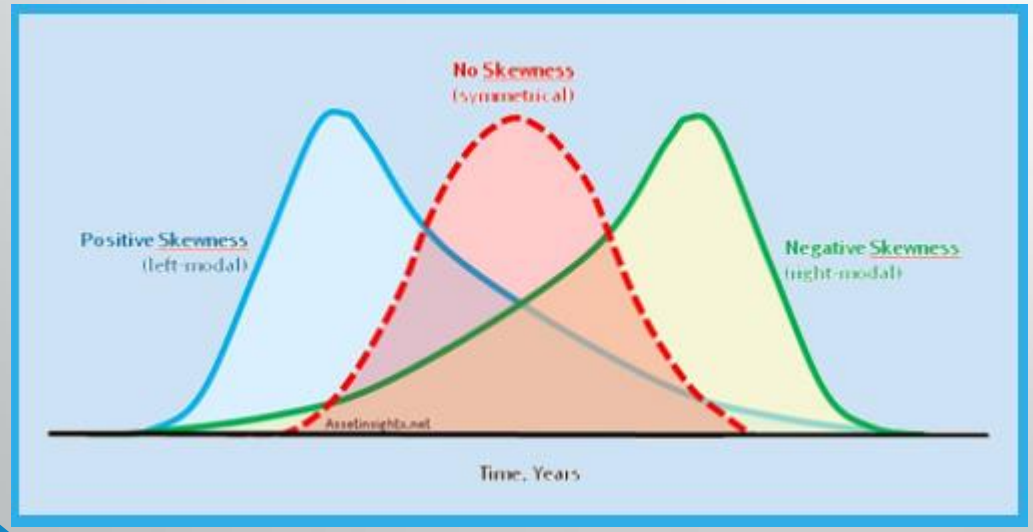
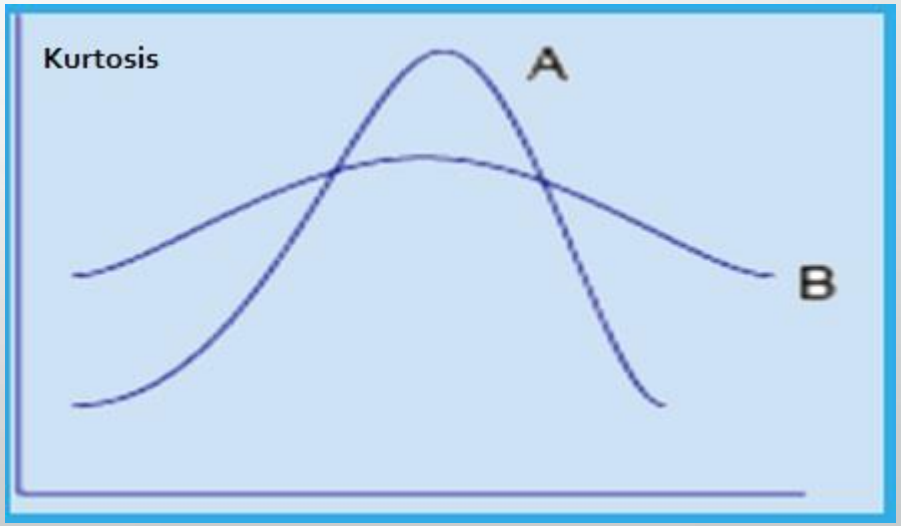
Introduction

- There is a considerable body of research on relative strength price momentum by considering the **1st central moment** but much less on the other central moments.
- First moment is the mean, the second moment is the variance, and the third moment is the skewness and the fourth central moment is kurtosis.





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Introduction

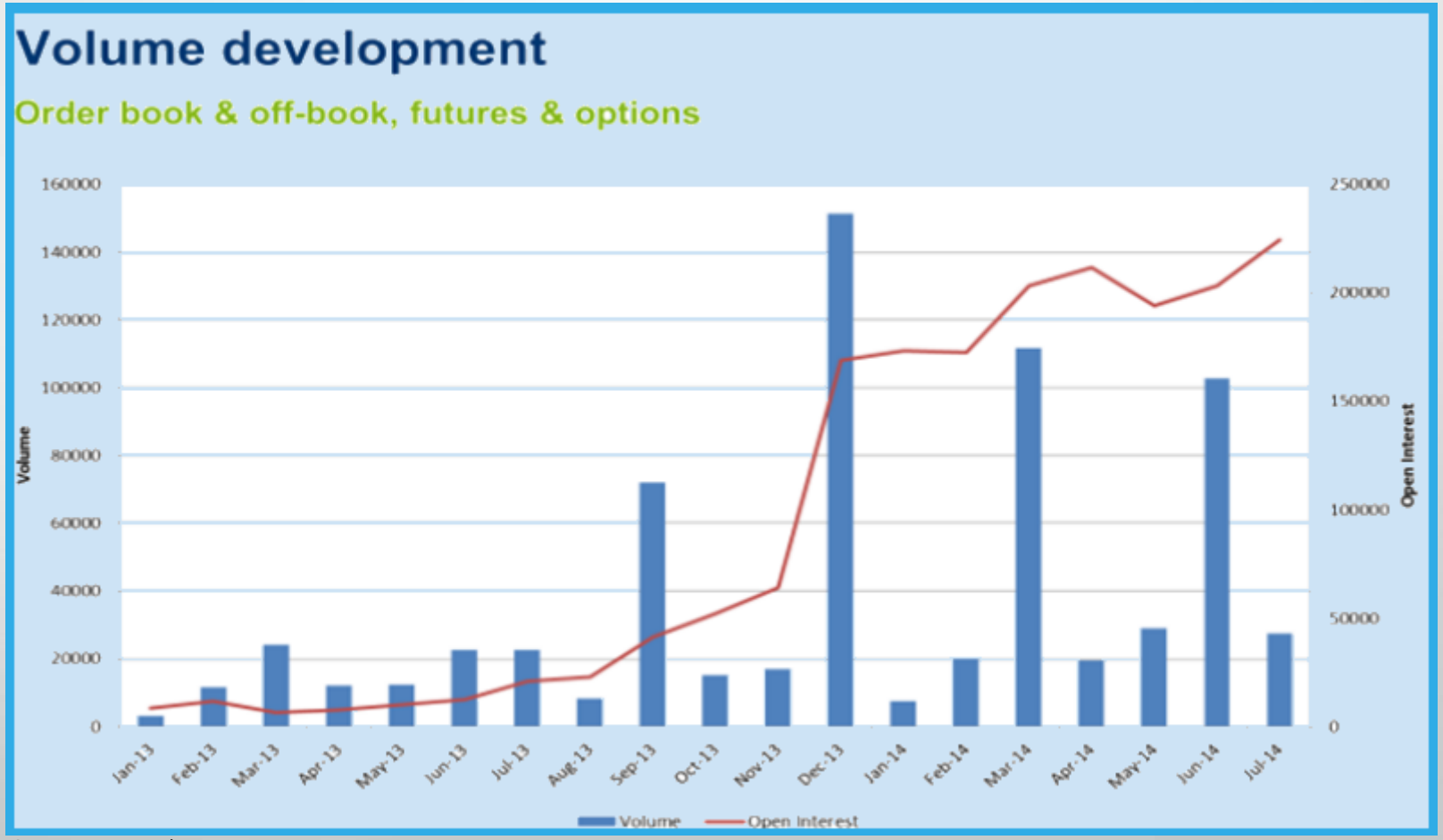
- The purpose of this paper is to extend the time series momentum (or trend following) model towards a **generalized momentum model of asset allocation** by combining mean, variance, skewness and kurtosis into one composite function by utilizing 26 MSCI Indexes.

Introduction

- Assets class selection
  - Country/Region Indexes (Futures) – the assets has relatively low correlation (as they cover developed, emerging and frontier markets) therefore it is possible to rotate between the asset classes and hold only asset classes with the highest probability of gain and lowest probability of loss.
  - Investors can now gain exposure to entire regions and single countries via Eurex Exchange's MSCI index derivatives offering.

Introduction

- Assets class selection
  - Total volume



Source: Eurex Exchange

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Introduction

- Assets class selection
  - Volume of products

Top Products - July 2014

Order book & off book

	Volume	OI
MSCI WORLD	**11,861**	**22,114**
FMWN - MSCI World	624	1,003
FMWO - MSCI World	9,517	11,376
OMWO - MSCI World	1,720	9,735
MSCI EUROPE	**7,918**	**54,971**
FMEU - MSCI Europe	2,668	32,421
OMEU - MSCI Europe	5,250	22,550
MSCI Emerging Markets	**5,202**	**13,576**
FMEM - MSCI Emerging Markets	10	24
OMEM - MSCI Emerging Markets	5,192	13,552
MSCI EM	**4,550**	**-**
OMEN - MSCI EM	4,550	-
MSCI Russia Index	**1,200**	**6,734**
FMRU - MSCI Russia Index	1,200	6,734

Source: Eurex Exchange

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Introduction

- Assets class selection
  - Liquidity: MSCI Europe

MSCI Eu IDX SEP4 DTB/EUX EUR DE000F91A7L6 15JUL14

	Order	Bid Size	Bid/Ask	Ask Size	Order	
0#FMEUU4		**158**	**176.60/176.70**	**301**		**01:00**
		ImpYld	/			
1st Best	1	158	176.6000/176.7000	301	3	14:35
2nd Best	1	50	176.5500/176.7500	50	1	
3rd Best	1	50	176.5000/176.8000	208	2	
4th Best	3	251	176.4500/176.8500	50	1	
5th Best	1	50	176.4000/176.9000	50	1	
6th Best	1	100	176.3000/	0		
7th Best		0	/	0		
8th Best		0	/	0		
9th Best		0	/	0		
10thBest		0	/	0		

Source: Reuters, quoted by Eurex Exchange

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Methodology - background

- An attempt to capture **momentum** and **trend reversal** phenomena
- Focus on close-to-close returns **distributions**
- Mean, variance, skewness and kurtosis used as **predictive factors**
- Portfolio's **Information Ratio** as an objective function

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Methodology - algorithm

1) For each period, assets ranked in descending order with respect to **four factors**
2) For each period and for each asset, **scores** are computed as an **weighted average** of **factors ranks**
3) For each period, all assets **ranked** in descending order with respect to scores
4) For each period, assets with **the lowest and highest** scores form in-sample portfolios
   - Each asset has an equal share in portfolio
5) Weights chosen so as **to maximize Information Ratio** of in-sample portfolios
6) Optimal **weights** used to obtain scores for next period and to construct **out-of-sample portfolio**

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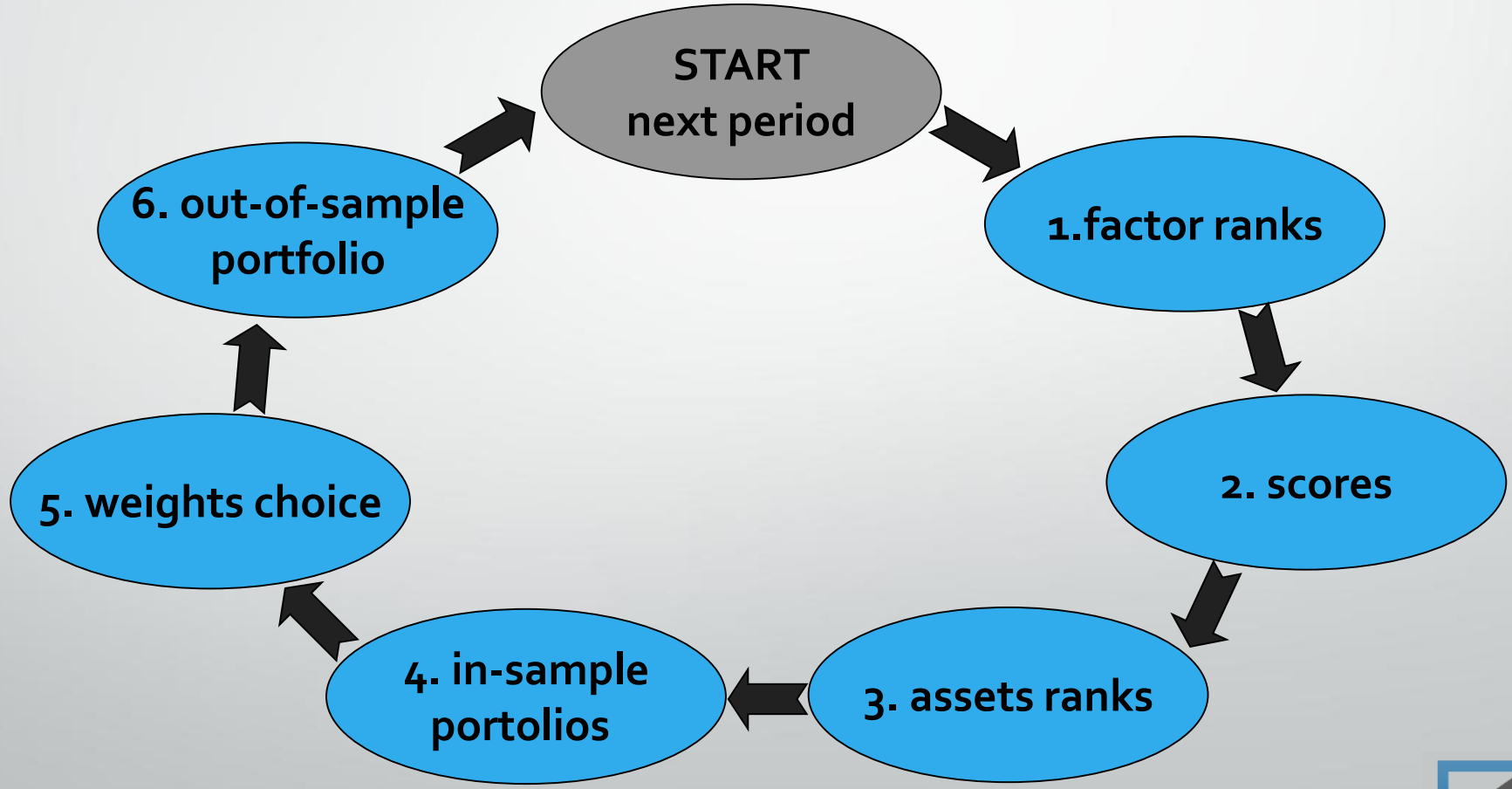
Algorithm – single loop



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Methodology - optimization

- **Grid search** optimization technique

- Five optimization **parameters**:
  1) **optimization precision** – default: **0.1**, additionally: 0.25, 0.5, 1
  2) **the width of factors rolling window** – default: **26** weeks, additionally: 13, 52
  3) **optimization window** – default: **52** weeks, additionally: 26, 78
  4) **number of chosen assets** (short and long) – default: **6**, additionally: 3, 9
  5) **rebalancing period** – default: **13** weeks

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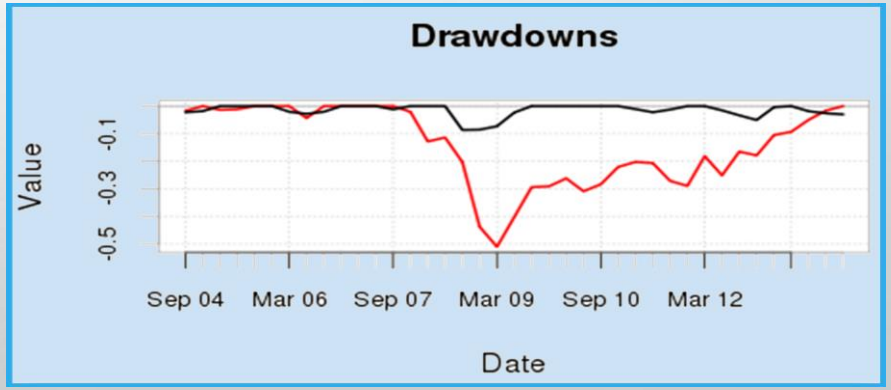
Data

- First choice: **MSCI Indexes futures**
- Ultimate choice: 26 **MSCI Indexes**
- Weekly close prices covering period from 1st January 2004 to 28th February 2014
- **MSCI World Index** as a benchmark

Results

Model	Annualized Return	Annualized St. Dev.	Information Ratio	MaxDD	Length of MaxDD (in quarters)	Net Information Ratio
Default Strategy	3.6%	5.5%	0.650	8.6%	7	0.566
Benchmark	4.6%	18.3%	0.254	51.1%	26	



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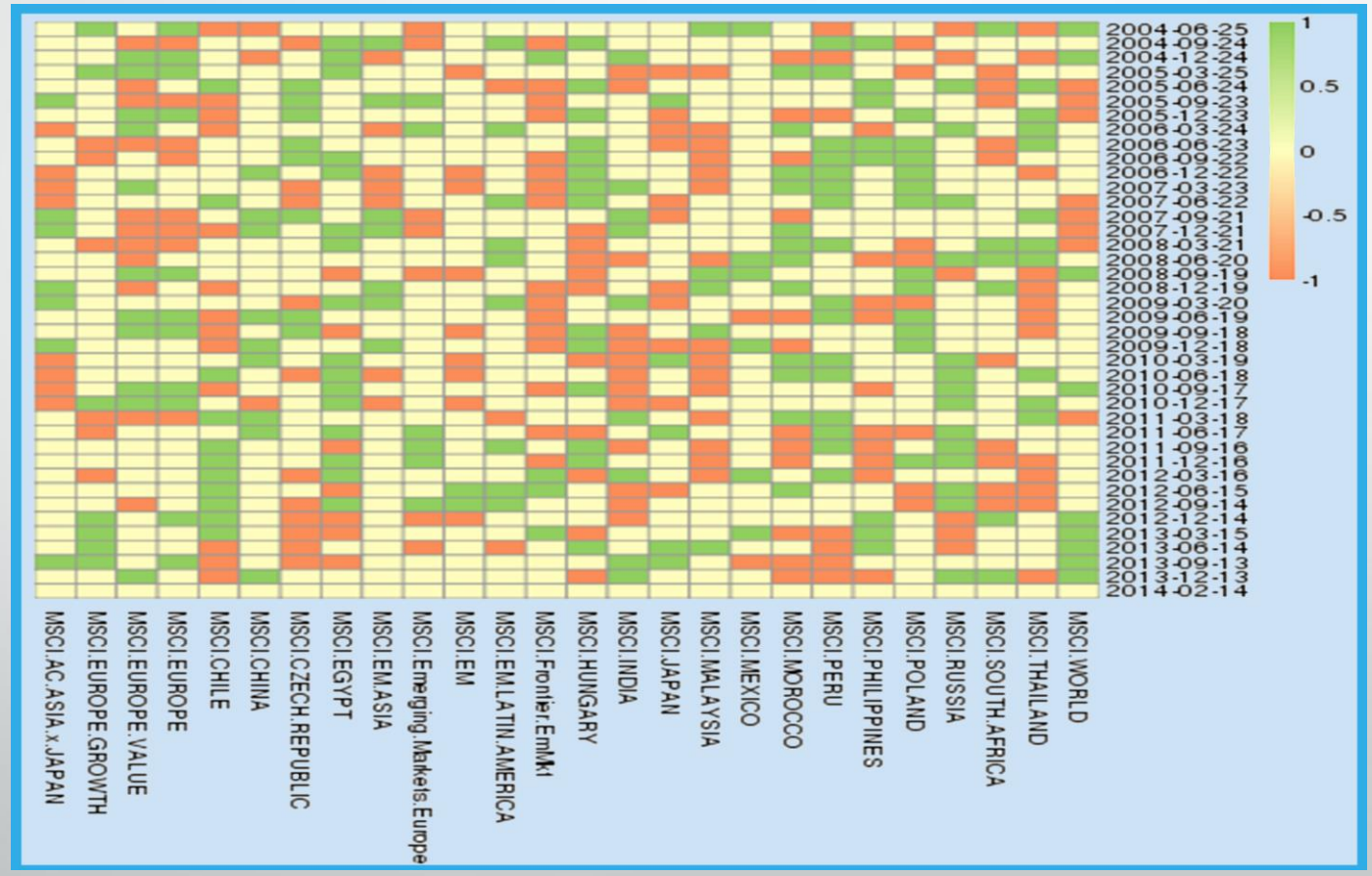
Structure of Portfolio



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Comparison of Information Ratios

			number of chosen assets			
weights opt. prec.	width of factors roll. window	optimisation window	3	6	9	Average
0,1	13	26	-0,21	0,18	-0,02	-0,02
		52	-0,07	0,45	-0,05	0,11
		78	-0,22	0,13	-0,23	-0,10
	26	26	0,06	0,27	0,31	0,22
		52	0,41	0,56	0,42	0,46
		78	0,02	0,11	0,16	0,10
	39	26	0,15	-0,13	0,22	0,08
		52	0,28	-0,17	-0,02	0,03
		78	0,22	-0,28	0,22	0,06
0,5	13	26	-0,07	-0,21	-0,09	-0,12
		52	0,31	0,30	0,11	0,24
		78	0,36	0,14	-0,20	0,10
	26	26	0,25	0,31	0,17	0,24
		52	0,51	0,45	0,45	0,47
		78	-0,09	0,01	0,51	0,14
	39	26	0,06	0,13	-0,27	-0,03
		52	-0,04	0,03	-0,03	-0,01
		78	0,41	0,07	-0,10	0,13
1	13	26	0,01	-0,04	-0,02	-0,02
		52	-0,10	0,09	-0,23	-0,08
		78	-0,39	-0,31	-0,65	-0,45
	26	26	0,24	0,36	0,36	0,32
		52	0,47	0,31	0,23	0,34
		78	-0,15	0,60	0,49	0,31
	39	26	0,04	-0,29	-0,11	-0,12
		52	0,36	0,20	-0,19	0,12
		78	0,32	-0,03	-0,20	0,03
Average			0,12	0,12	0,05	

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Sensitivity Analysis

weights opt. prec.	width of factors roll. window	optimisation window	number of chosen assets	net information ratio
0,05	26	52	6	**0,56 7**
0,1	26	52	6	**0,566**
0,5	26	52	6	**0,45**
1	26	52	6	**0,31**

weights opt. prec.	width of factors roll. window	optimisation window	number of chosen assets	Net Information Ratio
0,1	13	52	6	**0,45**
0,1	26	52	6	**0,56**
0,1	39	52	6	**-0,17**

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Sensitivity Analysis

weights opt. prec.	width of factors roll. window	optimisation window	number of chosen assets	Net Information Ratio
0,1	26	26	6	**0,27**
0,1	26	52	6	**0,56**
0,1	26	78	6	**0,11**

weights opt. prec.	width of factors roll. window	optimisation window	number of chosen assets	Net Information Ratio
0,1	26	52	3	**0,41**
0,1	26	52	6	**0,56**
0,1	26	52	9	**0,42**

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Regression analysis: sensitivity of parameters

variable	default value	alternative value	coefficient	standard error	t- statistic	p-value
optimization precision	0.1	0.25	-0.0668	0.0595	-1.12	0.264
		0.5	-0.0052	0.0595	-0.09	0.931
		1	-0.0488	0.0595	-0.82	0.414
width of factors rolling window	26	13	-0.2084	0.0515	-4.05	0.000
		39	-0.2582	0.0515	-5.01	0.000
optimization window	52	26	-0.2277	0.0515	-4.42	0.000
		78	-0.1406	0.0515	-2.73	0.008
number of chosen assets	6	3	-0.0624	0.0515	-1.21	0.229
		9	-0.1122	0.0515	-2.18	0.032
constant	-	-	0.5850	0.0665	8.79	0.000
test					statistic	p-value
Jarque-Bera test for residuals normality					0.23	0.892
Breusch-Pagan test for heteroskedasticity					0.03	0.861

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Sensitivity to the level of leverage

Model	Annualized Return	Annualized St. Dev.	Infromation Ratio	MaxDD	Length of MaxDD	Net Information Ratio
Default Strategy	00.36	0.55	0.650	0.086	7	0.566
Default Strategy with leverage 2:1	0.070	0.136	0.517	0.323	14	0.457
Benchmark	0.046	0.183	0.254	0.511	26	

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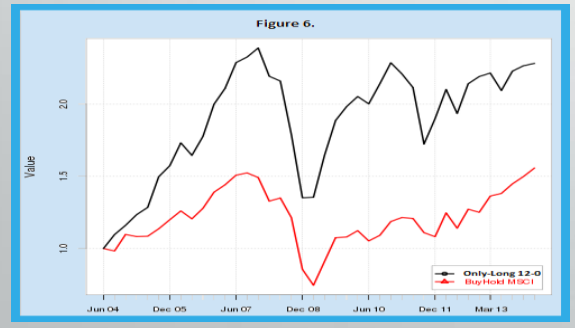
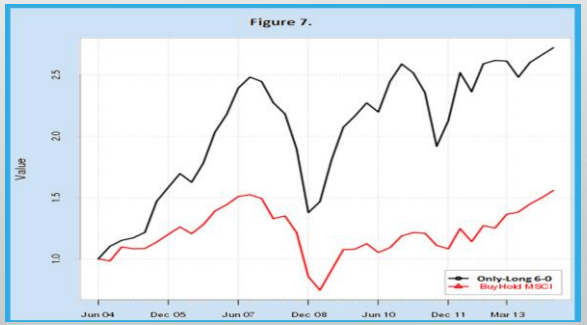
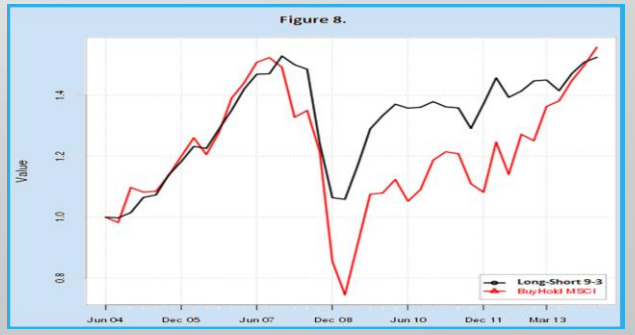
Default Strategy vs Long-only and Long-hedged

Model	Annualized Return	Annualized St. Dev.	Information Ratio	MaxDD	Length of MaxDD (in quarters)	Net Information Ratio
Deafult Strategy	3.6%	5.5%	0.650	0.086	7	0.566
Strategy Only-Long 12-0	8.8%	18.7%	0.473	0.434	26	0.448
Strategy Only-Long 6-0	10.8%	20.1%	0.539	0.445	13	0.511
Strategy Long-Short 9-3	4.4%	10.4%	0.427	0.307	26	0.382
Benchmark	4.6%	18.3%	0.254	0.511	26	







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Conclusions

- default model over performs the benchmark(MSCI World Index)
- significant reduction in performance model volatility
- strategy profitable after costs incorporation
- MSCI Indexes futures are perspective investment asset

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Extensions

- Apply alternative factors describing single assets
- Test different performance measures (Roy's Safety First Ratio, Sortino Ratio or Treynor Ratio)
- Consider not equal shares of assets in portfolio

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Thank You!