

USE OF THE GLOBAL EQUITY MODEL (GEM LT) IN MSCI INDEX CONSTRUCTION

Index Transition Proposals for Discussion

January 2017

This consultation may or may not lead to changes in the highlighted MSCI indexes

AGENDA

Overview of the Barra 'GEM LT' Equity Model*

Methodology proposals for the proposed transition of:

- MSCI Minimum Volatility Indexes
- MSCI Diversified Multiple-Factor (DMF) Indexes
- MSCI Low Carbon Indexes (Target/Leaders)
- MSCI ESG Focus Indexes
- MSCI USA ESG Select Index

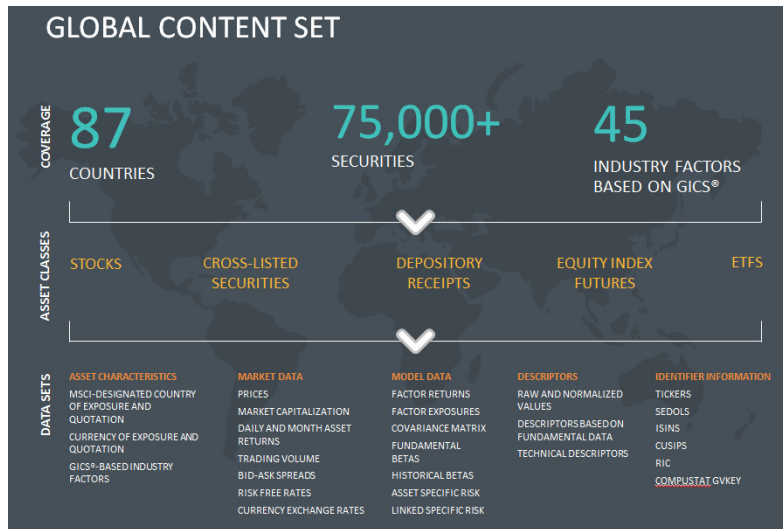
Historical Analysis & Transition Analysis

Appendix

OVERVIEW OF THE GEM LT MODEL

GEM LT: A BETTER EQUITY MODEL FOR BETTER INDEXES

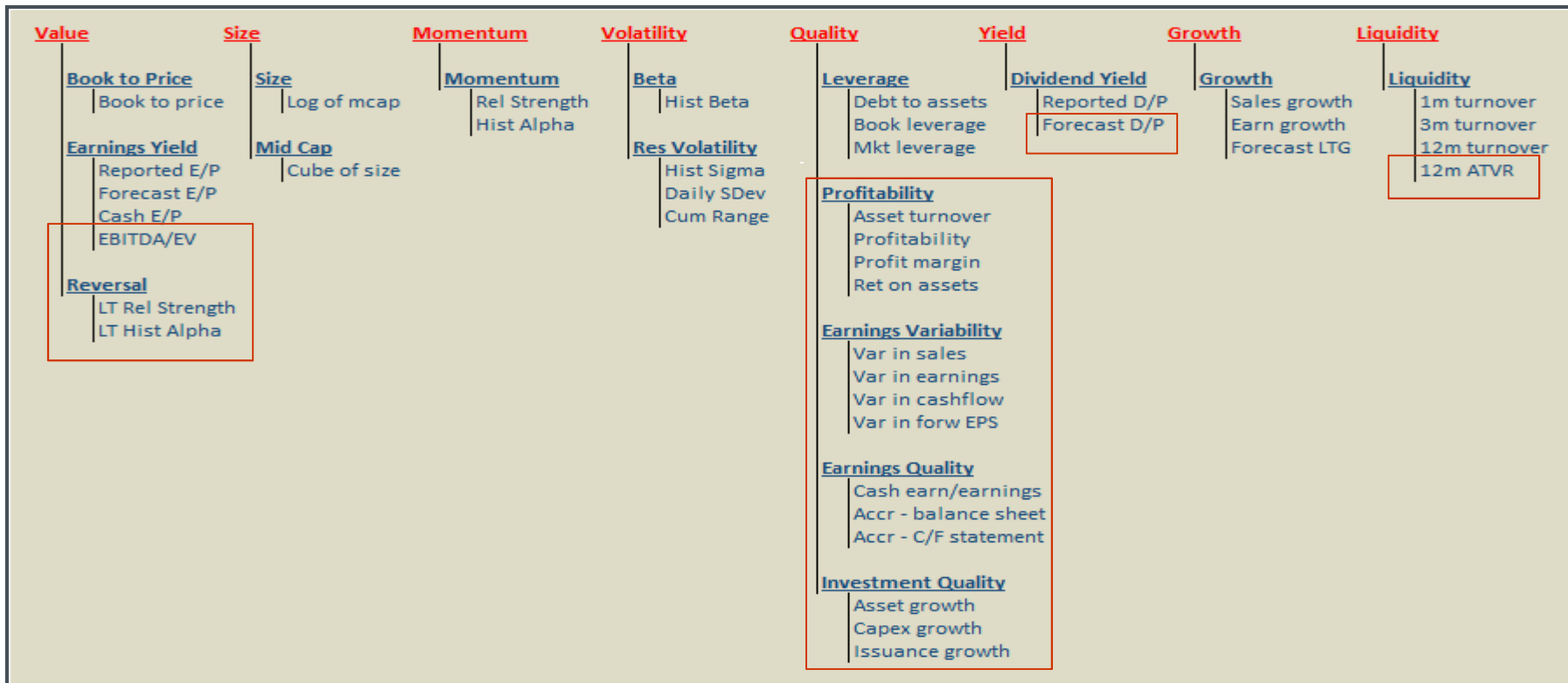
- An Improved Equity Model: Better Risk Estimation, Better Index Design
 - Enhanced style factors based on Systematic Equity Strategies*
 - Point-in-Time fundamental data to help address look-ahead bias
 - First Barra global equity model with multi-industry exposures
 - Dynamically adjusted country and industry exposures
 - Alignment of factor set and responsiveness with investment horizon



*Bayraktar, Mehmet K., Stan Radchenko, Kurt Winkelmann and Peter J. Zangari (2013) *Employing Systematic Equity Strategies: Distinguishing Important Sources of Risk from Common Sources of Return*. MSCI Research

OVERVIEW OF THE MSCI 'GEM LT' GLOBAL EQUITY MODEL

- MSCI launched a new Global Equity Model for Long Term Investors (GEM LT) in 2015
- Comprehensive global equity factor structure: 16 factors based on 41 descriptors
- Addition of an extensive set of quality factors for the first time



Source: MSCI Global Equity Total Market Model. Factors and descriptors highlighted in red were introduced in the latest global model.

GEM LT VS. GEM2: A MODEL COMPARISON

- GEM2 is the model currently used for MSCI Min Vol and DMF Factor Indexes
- Additional Style Factors:
 - 16 style factors in GEM LT vs. 8 in GEM2
- No explicit quality factors and no differentiated value factors in GEM2
- Dynamic adjustment of country/industry exposure based on historical sensitivity
 - In the GEM2 model, industry and country factors are 0/1
- Exposure to multiple industry factors
 - In GEM2, each stock only has exposure to one industry factor

GEM LT VS GEM2 – A DEEP-DIVE ON STYLE FACTORS

- There is a 1-to-1 relationship between six of the GEM2 and GEM LT styles
- Value is broken into four factors in GEM LT
- Volatility is now split into Beta and Residual Volatility (Res. Vol.)
- Four new factors to help represent quality focus on earnings variability, earnings quality, investment quality and profitability

GEM2	GEMLT
Growth	Growth
Liquidity	Liquidity
Size Non Lin.	Mid Cap
Momentum	Momentum
Size	Size
Value	BtoP
	Earn. Yield
	Div Yield
	LT Rev.
Volatility	Beta
	Res. Vol.
Leverage	Leverage
	Earn. Var.
	Earn. Quality
	Inv. Quality
	Profitability

} Quality

MINIMUM VOLATILITY INDEXES

Extended constraints for a new equity risk model

MINIMUM VOLATILITY INDEX METHODOLOGY

Parameter	Methodology	Comments
Universe	Parent index constituents	Is not affected by any model change.
Optimization	MSCI's Barra Global Equity Model (GEM2)	Propose moving to GEM LT model
Weighting	Minimize index volatility subject to constraints	Objective remains the same
Constraints	<ul style="list-style-type: none"> • Stocks: Lower of 1.5% or 20x the cap-weight, with a minimum of 5bps • Sectors: -/+5% relative to the parent index • Countries: -/+5% or 3x relative to the parent index • Style: -/+ 0.25 relative to Barra factor of the parent index (except for Volatility) • Turnover: Maximum 10% one-way turnover per rebalancing 	<ul style="list-style-type: none"> • No change to stock-level constraints • Sector and country constraints not model-dependent and remain the same • Style exposures are model dependent and need review • Turnover needs analysis (both for transition as well as ongoing)
Number of Constituents	Subset of parent index, number will vary	Not affected by model change
Rebalancing	Semi-annual (May and November)	Not affected by model change

TURNOVER – TWO QUESTIONS FOR PROPOSED TRANSITION

Transition:

- Should we relax the Turnover (TO) constraint for the proposed index transition?
 - We relaxed the TO constraints when moving from GEM to GEM2 (Nov. 2009)
 - It was needed since the model changes were very material
 - Do we also need to give some extra TO budget in transitioning to GEM LT?
 - If so, how much?

Ongoing:

- Do we need to change the general TO constraint due to changes in the Model?

STYLE FACTORS – GEM LT VS GEM2

- Style Factors Constraints:
 - Style factors are constrained in the Minimum Volatility Index methodology to avoid unintended factor exposures
 - Using GEM2 at present, there are 8 style factors
 - All but ‘Volatility’ are constrained to be within 0.25 standard deviations of the parent index
- The number of style factors has increased to 16 in GEM LT
 - **Which ones should we constrain?**
 - **What is the historical impact?**

GEM2	GEMLT
Growth	Growth
Liquidity	Liquidity
Size Non Lin.	Mid Cap
Momentum	Momentum
Size	Size
Value	BtoP
	Earn. Yield
	Div Yield
	LT Rev.
Volatility	Beta
	Res. Vol.
Leverage	Leverage
	Earn. Var.
	Earn. Quality
	Inv. Quality
	Profitability

POSSIBLE FACTOR CONSTRAINTS WITH GEM LT

- Intuition prior to empirical analysis:

The same constraints should be applied to all GEM LT factors *except* Beta, Residual Volatility, Earnings Variability

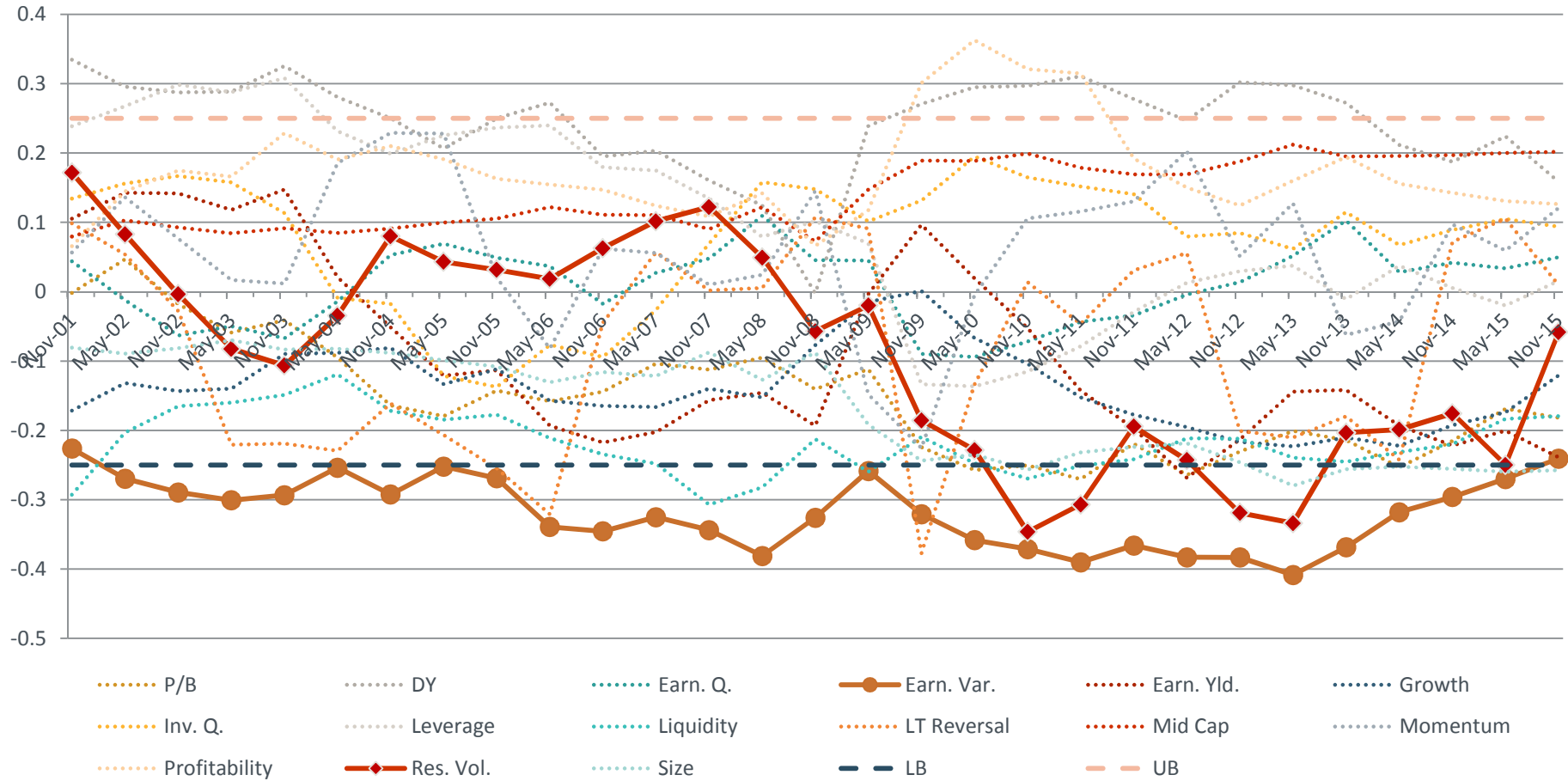
GEM2

- **Volatility:**
 - Historical Beta
 - Historical Sigma
 - Daily Standard Deviation
 - Cumulative Range

GEM LT

- **Beta:**
 - Historical Beta
- **Residual volatility**
 - Historical Sigma
 - Daily Standard Deviation
 - Cumulative Range
- **Earnings Variability**
 - Variability in Sales
 - Variability in Earnings
 - Variability in Cash Flow
 - Std. Dev. Analysts Pred. E/P

GEM LT FACTOR EXPOSURE OF MSCI WORLD MV INDEX



Note: We see similar graphs for other regions and countries as well as across Standard, Small Cap and IMI indexes

CONSTRAINT PROPOSAL FOR MIN VOL INDEXES

- GEM LT factor exposures of existing indexes have been within 0.25 standard deviations of the parent index at rebalance
 - Limiting these factors should not have a material impact
- **Consistency with the index objective:**
Beta and Residual Volatility constraints should be unconstrained
- **Earning Variability:**
 - Intuitively, this factor is a representative of volatility (volatility of earning, sales, etc. ‘translates’ into volatility of the associated stock return)
 - Our analysis showed a persistent and relatively large exposure to this factor
- **Factor Constraint Proposal:**
Constrain all the style factor exposure to be within +/-0.25 s.d. of the parent index except:
 - Beta
 - Residual Volatility
 - Earnings Volatility

MSCI WORLD MIN VOL INDEX – SUMMARY RISK METRICS

Key Risk Metrics

	MSCI World Index	MSCI World Minimum Volatility USD Index	MSCI World Min Vol Gem2I Index	MSCI World Min Vol Gemtl V1 Index	MSCI World Min Vol Gemtl V2 Index
Absolute Risk Metrics					
Total Risk* (%)	15.5	10.9	10.5	10.3	10.3
Annualized Downside Deviation* (%)	10.9	7.6	7.1	7.0	7.0
Sortino Ratio*	0.41	0.90	1.08	1.08	1.07
VaR @ 95%	-8.4	-5.0	-4.9	-5.1	-5.2
VaR @ 99%	-11.3	-8.7	-8.1	-8.3	-8.2
Expected Shortfall (CVaR) @ 95%	-10.5	-7.7	-7.2	-7.2	-7.2
Expected Shortfall (CVaR) @ 99%	-15.4	-12.8	-11.9	-11.8	-11.7
Max Drawdown (%)	57.5	47.7	43.1	42.5	42.7
Max Drawdown Period (in months)	16	16	16	16	16
Skewness	-0.62	-1.05	-0.97	-1.02	-1.02
Kurtosis	4.38	6.26	5.56	5.56	5.54
Relative Risk Metrics					
Tracking Error* (%)	0.0	7.7	7.9	8.0	8.0
Max Drawdown of Active Returns (%)	0.0	17.4	18.2	20.9	21.2
Max Drawdown of Active Returns Period (in months)	0	27	27	27	27

* Annualized in USD

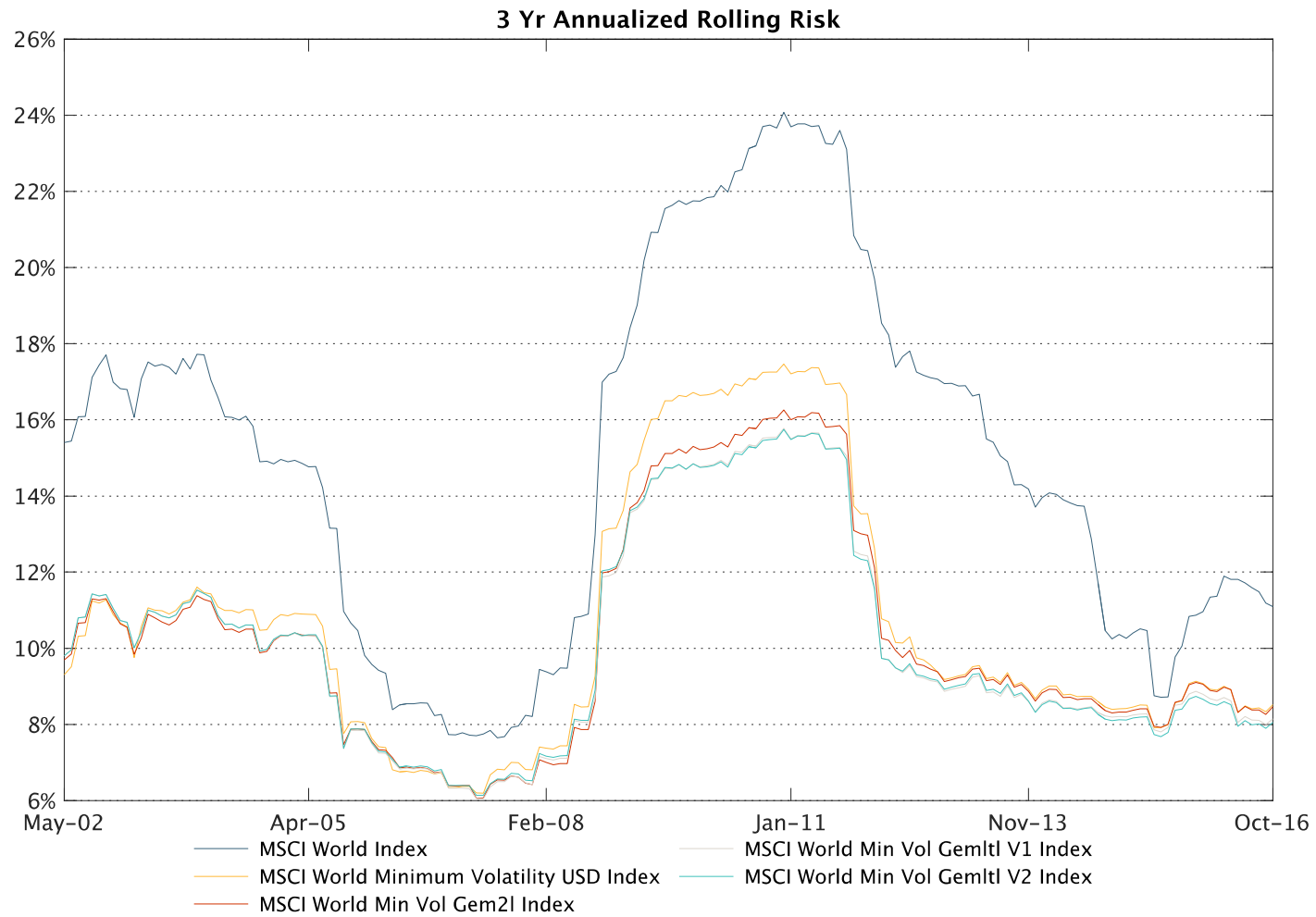
Period: 31-May-1999 to 31-Oct-2016

GEM2L Index: Simulated Min Vol index using GEM2 model – for comparison

V1: Unconstrained Factors: Beta, Residual Volatility, Earning Variability – **Proposed Approach**

V2: Unconstrained Factors: Beta, Residual Volatility – for comparison

ROLLING REALIZED VOLATILITY OF MIN VOL INDEXES



KEY METRICS: RETURN, VALUATION, INVESTABILITY

Key Metrics

	MSCI World Index	MSCI World Minimum Volatility USD Index	MSCI World Min Vol Gem2l Index	MSCI World Min Vol Geml V1 Index	MSCI World Min Vol Geml V2 Index
Total Return* (%)	4.5	6.8	7.7	7.6	7.6
Total Risk (%)	15.5	10.9	10.5	10.3	10.3
Return/Risk	0.29	0.63	0.73	0.74	0.73
Sharpe Ratio	0.15	0.43	0.53	0.54	0.53
Active Return (%)	0.0	2.4	3.2	3.2	3.1
Tracking Error (%)	0.0	7.7	7.9	8.0	8.0
Information Ratio	NaN	0.31	0.41	0.39	0.39
Historical Beta	1.00	0.63	0.60	0.59	0.59
Turnover** (%)	3.0	25.3	20.0	20.1	20.1
Price To Book	2.2	2.5	2.4	2.5	2.5
Price to Earnings	18.4	18.9	18.9	18.6	18.6
Dividend Yield(%)	2.3	2.7	2.7	2.6	2.6
Concentration Metrics					
Avg No of Stocks	1623	280	316	326	330
Effective No of Stocks	318	154	178	177	179
Liquidity Metrics					
Weighted Average ATVR (%)	101.2	82.8	82.0	80.2	81.5

Period: 31-May-1999 to 31-Oct-2016

* Gross returns annualized in USD

** Annualized one-way index turnover over index reviews

AVERAGE ACTIVE FACTOR EXPOSURE (GEM LT ANALYSIS)

Factor	MSCI World Minimum Volatility USD	MSCI World Min Vol Gem2I	MSCI World Min Vol GemItl V1	MSCI World Min Vol GemItl V2
BtoP	-0.13	-0.10	-0.12	-0.11
Earn. Yield	-0.06	-0.08	-0.06	-0.06
Size	-0.16	-0.23	-0.24	-0.24
Mid Cap	0.14	0.19	0.19	0.19
Momentum	0.05	0.06	0.05	0.05
LT Reversal	-0.05	-0.02	-0.01	-0.01
Beta	-0.82	-0.89	-0.92	-0.91
Res. Vol.	-0.05	-0.12	-0.13	-0.12
Leverage	0.11	0.06	0.09	0.10
Earn. Qlty	0.02	0.04	0.05	0.06
Inv. Qlty	0.08	0.12	0.15	0.14
Profitability	0.15	0.16	0.19	0.19
Earn. Var.	-0.29	-0.29	-0.29	-0.24
Div. Yield	0.24	0.26	0.22	0.22
Growth	-0.14	-0.17	-0.17	-0.16
Liquidity	-0.21	-0.22	-0.21	-0.21

AVERAGE ACTIVE SECTOR WEIGHTS COMPARISON

	MSCI World Minimum Volatility USD	MSCI World Min Vol Gem2l	MSCI World Min Vol Gemtl V1	MSCI World Min Vol Gemtl V2
Energy	-4.1	-2.5	-2.3	-2.3
Materials	-2.8	-2.5	-2.6	-2.5
Industrials	0.3	-1.8	-1.2	-1.4
Consumer Discretionary	-2.2	-1.5	-1.6	-1.5
Consumer Staples	6.3	5.0	4.9	4.9
Health Care	4.0	4.7	4.4	4.4
Financials	-6.4	-9.3	-8.7	-8.7
Information Technology	-7.4	-4.7	-4.6	-4.7
Telecommunication Services	2.4	2.3	2.3	2.4
Utilities	6.3	5.1	5.0	5.0
Real Estate	3.6	5.2	4.4	4.3

Period: 31-May-1999 to 31-Oct-2016

	MSCI World Minimum Volatility USD	MSCI World Min Vol Gem2l	MSCI World Min Vol Gemtl V1	MSCI World Min Vol Gemtl V2
Energy	-4.7	-4.8	-4.8	-4.8
Materials	-1.2	-1.0	-2.8	-2.7
Industrials	-2.9	-3.3	-3.4	-3.6
Consumer Discretionary	-2.0	-2.2	-0.3	-0.2
Consumer Staples	4.9	4.9	5.0	5.0
Health Care	4.9	4.9	3.7	3.7
Financials	-6.9	-6.9	-6.2	-6.2
Information Technology	-5.4	-5.3	-5.4	-5.3
Telecommunication Services	5.0	5.0	4.8	4.8
Utilities	5.1	5.2	5.2	5.1
Real Estate	3.2	3.4	4.3	4.2

Period: 31-Dec-2013 to 31-Oct-2016

- Difference in the historical average sector exposure of the existing Min Vol index and simulation indexes arises partly from prior use of the earlier Barra GEM model and also historical changes to the MSCI cap-weighted index methodology since 1999
- The differences in more recent history, which excludes such material changes, were small

TRANSITION TURNOVER ANALYSES: SET-UP

- Take MSCI World Min Vol (USD) and simulate a transition in the November 2016 Semi-Annual rebalance
- Start from existing Min Vol index just before rebalance
 1. Rebalance with GEM2 for optimization – Turnover of 10%
 2. Rebalance as above but using GEM LT (again, Turnover of 10%)
 3. Rebalance as 1, using GEM2 with no turnover constraint
 4. Rebalance as 2, using GEM LT with no turnover constraint
- Key metrics for analysis
 - Looking at how different the indexes are at stock level (Active Share)
 - Comparing estimated (ex-ante) risk forecasts

TRANSITION SIMULATION: ACTIVE SHARE ANALYSIS

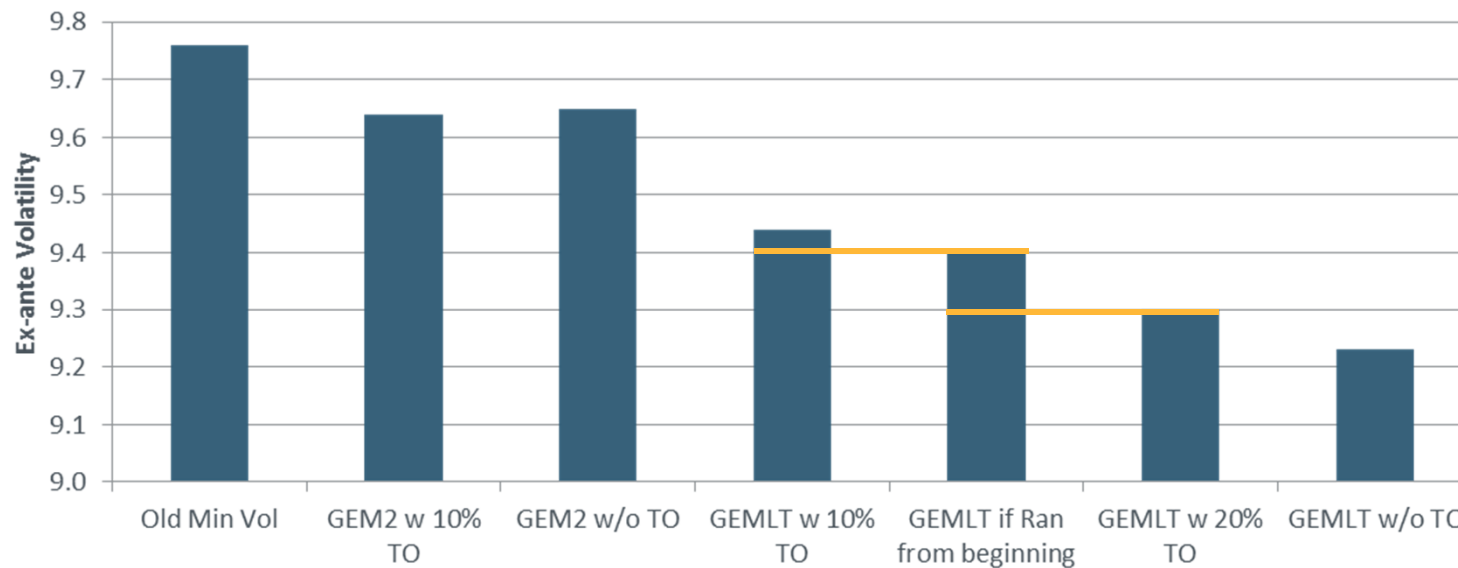
- How different are the versions of the World Min Vol index based on active share?

	Old Min Vol	GEM2 w 10% TO	GEMLT w 10% TO	GEM2 w/o TO	GEMLT w/o TO
Old Min Vol					
GEM2 w 10% TO	10.0%				
GEMLT w 10% TO	10.0%	9.6%			
GEM2 w/o TO	38.3%	28.5%	31.9%		
GEMLT w/o TO	38.3%	32.7%	28.3%	28.0%	

- Highlights:
 - If we continued using GEM2, the TO-constrained version would have had 28.5% active share relative to the non TO-constrained one
 - The GEM LT version is also 28.3% from its unconstrained version
 - The relative active share between the two TO-constrained indexes is **9.6%**

TRANSITION SIMULATION: ESTIMATED RISK VS. TURNOVER

- We compare the estimated risk (from the viewpoint of GEM LT equity model)
 - If we had started the Min Vol index simulation with GEM LT from the start, then for the Nov '16 rebalancing, the ex-ante risk would have been 9.40%
 - In the transition with 10% turnover, the ex-ante risk is 9.44%
 - An **extra 10% turnover** budget ensured that the risk reduction beat the hurdle of the long-run GEM LT simulation

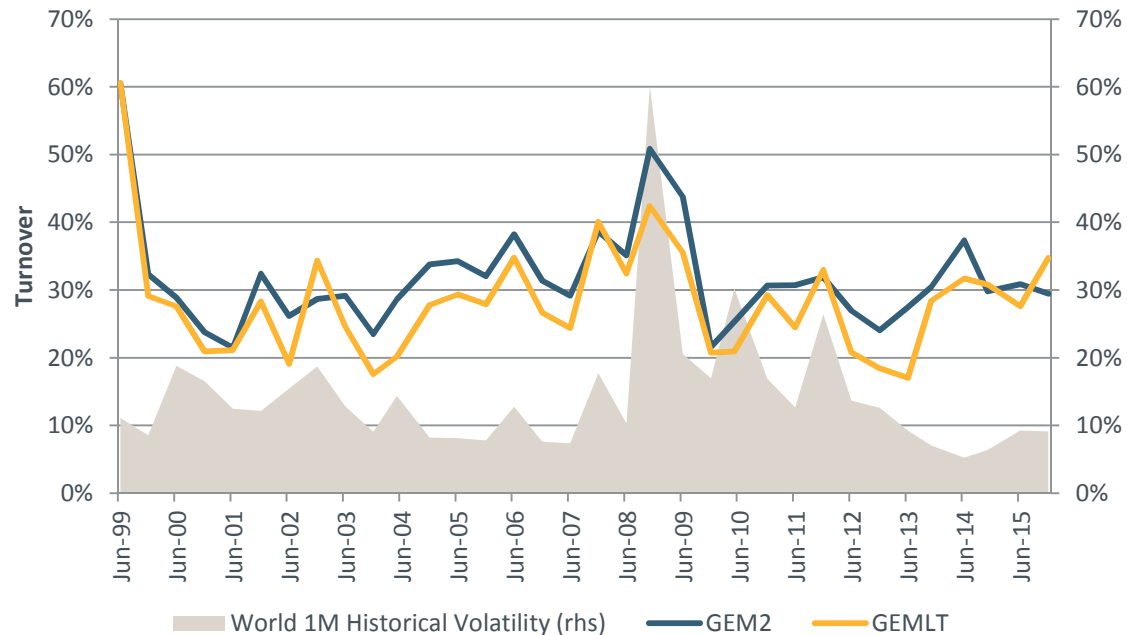


TURNOVER FOR ONGOING INDEX CALCULATION WITH GEM LT

- Is the existing 10% standard allowance enough for a GEM LT based Min Vol index?
- We simulated four versions of World Minimum Volatility indexes
 - 1998 to 2016
 - Using GEM2 and GEM LT
 - With and without any turnover constraints
- Key analysis metrics:
 - Estimated Risk and Turnover

TURNOVER OF MIN VOL INDEXES WITH TWO MODELS

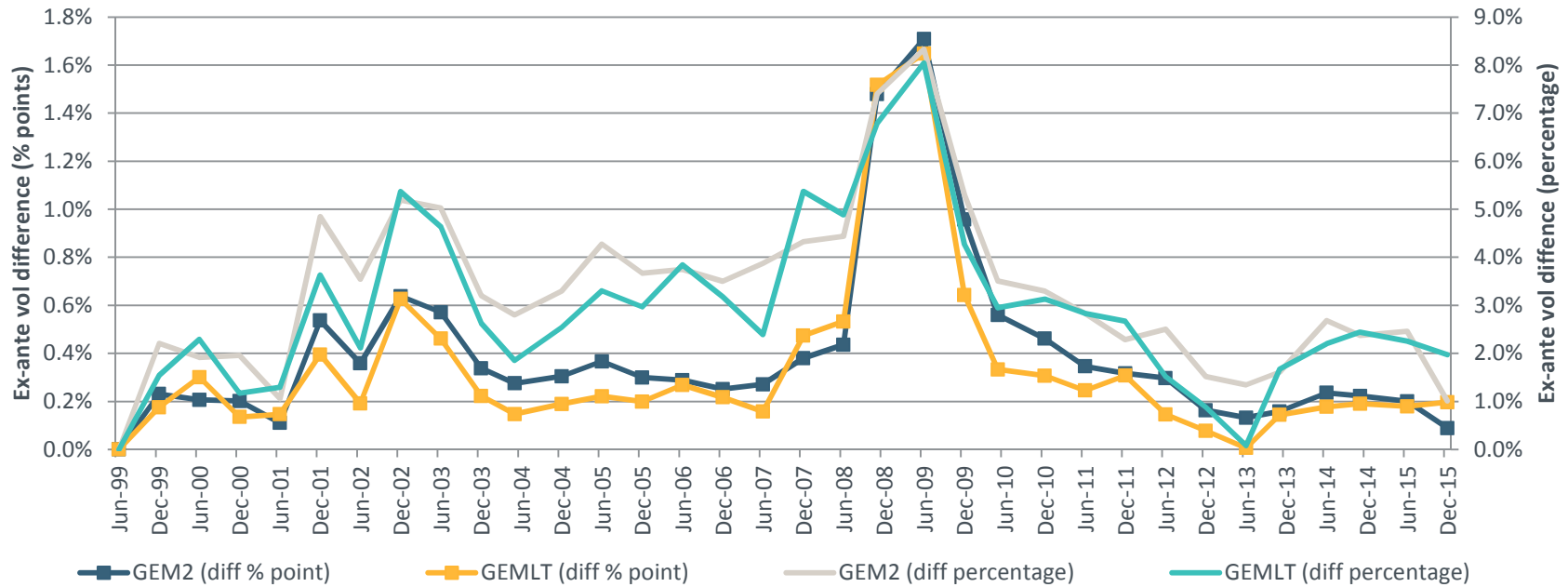
- Turnover of Min Vol index in simulation if we imposed no constraint on turnover



- Observations:
 - In general, GEM LT seems to have been more stable (less turnover on rebalancing)
 - Overall market volatility will affect the required turnover estimate and active share.

ESTIMATED RISK COMPARISON

- Comparing simulations with- and without the turnover constraint imposed



- Whether looking at absolute difference (with- vs without TO constraints) or the percentage difference, the impact of turnover on the GEM LT version has been smaller in simulation

MIN VOL INDEX TRANSITION PROPOSAL: SUMMARY

- GEM LT is a more advanced global equity model with better risk predictability and many improved characteristics compared to GEM2
- Analysis demonstrated creating Min Vol indexes with GEM LT improves the index in terms of volatility reduction with little difference in other metrics

Key discussion points

- For style factors, we proposed all factors are constrained as before except for Beta, Residual Volatility and Earnings Variability
 - *Do you agree with this list of unconstrained factors?*
- We propose an additional turnover budget of 10% - is this reasonable?
 - Our analysis indicates across a range of country and regional indexes that around 70% of the risk reduction on an unconstrained transition is achieved with a 20% turnover budget vs 50% for the usual 10% budget
- Do you agree with keeping the ongoing turnover constraint at 10%?

FURTHER DISCUSSION POINTS FOR MIN VOL INDEXES

- Would there be a benefit to **additional liquidity filtering** for positions or rebalance trades?
 - Should we exclude recent and currently suspended stocks from the eligible universe?
 - Should we increase the ATVR or FOT screens above GIMI requirements for additions?*
- Does it make sense to have a **minimum trade size** for SAIR rebalances?
 - Should we eliminate trades below, say, 5 bps unless it is to close the position?
- Should the **valuation constraints** be tightened to help control for one dimension of crowding?
- Should the rebalance be adjusted by introducing **uncertainty into the model sourcing date**?
 - The SAIR price cutoff date can be any one of the 10 business days before prior month-end
 - e.g we could pick any of the 10 days prior to T-9 for the GEM LT data and parent index wts
- The current set-up has active country/sector constraints, but no region/currency bloc controls
 - Should we **limit active currency positions to +/-5%** for example?
 - Would that constraint be too limiting on country risk for e.g. the Eurozone in MSCI World?

MSCI DIVERSIFIED MULTIPLE-FACTOR INDEX (DMF)

Propose use of GEM LT for optimization and factor definition in index transition

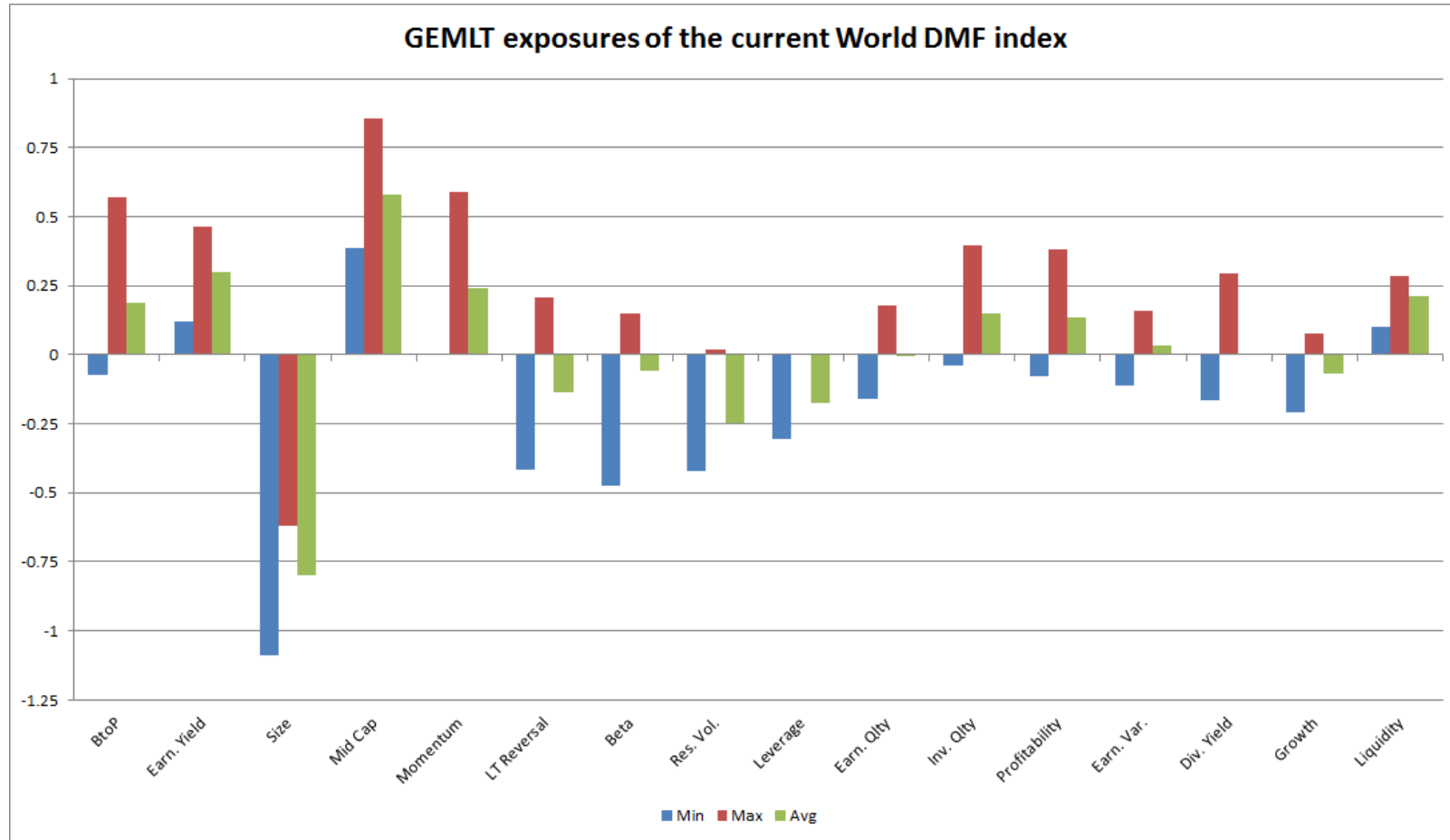
MSCI DMF INDEXES METHODOLOGY

Parameter	Methodology	Comments
Universe	Parent index constituents	Not affected by model change.
Optimization Model	Barra Global Equity Model (GEM2)	Proposed move to GEM LT
Objective	Maximize alpha while targeting parent total risk subject to constraints	Objective remains the same
Alpha (target factors)	<ul style="list-style-type: none"> Value, Momentum, Low Size, Quality 	<ul style="list-style-type: none"> Source of factor exposures may be re-considered
Constraints (non-target factors)	<ul style="list-style-type: none"> Stocks: Lower of (cap-weight+2% or 10x the cap-weight) Sectors: -/+5% relative to the parent index Countries: -/+5% or 3x relative to the parent index Style: -/+ 0.25 relative to Barra factor of the parent index (except for target factors) Turnover: Maximum 20% one-way turnover per rebalancing 	<ul style="list-style-type: none"> No change to stock level constraints Sector and country constraints are not dependent on the model and should remain the same Style exposure are model dependent and need review Turnover needs analysis for proposed transition as well as ongoing
Number of Constituents	Subset of parent index, number will vary	High level of diversification achieved by a subset of parent index
Rebalancing	Semi-annual (May and November)	No change required

POINTS TO CONSIDER FOR MODEL TRANSITION

- **Style Factors:**
 - Style factors constrained for non-target factors in methodology to avoid unintended factor exposures
 - With GEM2, following factors are constrained to be within +/- 0.25 of the parent index
 - Volatility
 - Growth
 - Liquidity
 - **The number of style factors has increased to 16 in GEM LT: what should be constrained?**
- **Quality and Value factor definition:**
 - Unlike GEM2, GEM LT has explicit factors for the Quality family. We propose they be used for representing Quality factor. We also propose using Value from GEM LT for consistency.
 - **What combination of these new factors makes sense for the proposed transition?**
- **Turnover:**
 - **Do we need to give extra turnover budget in transitioning DMF indexes to GEM LT?**
 - Do we need to change the turnover constraint itself due to the change in the Model?

CURRENT FACTOR EXPOSURES USING GEM LT FACTORS



Non-target factors i.e. Growth, Liquidity, Beta and Residual Volatility have remained within the range of +/-0.25 on an average, hence could be constrained in any GEM LT version

DMF INDEX METHODOLOGY PROPOSAL

Parameter	MSCI World DMF GEM2L Case 1	MSCI World DMF GEM LT EVSNQ Case 2	MSCI World DMF GEM LT ALL Case 3
Alpha Term	Value Score(EV), Quality Score(SNQ), Momentum(GEM2), Size(GEM2)	Value Score(EV), Quality Score(SNQ), Momentum(GEM LT), Size(GEM LT)	Value (GEM LT)* Quality (GEM LT)** , Momentum(GEM LT) Size(GEM LT)
1. Target factors	Unconstrained (Value, Momentum, Size, Mid Cap, Leverage)	Unconstrained (BtoP, Earn. Yield, Earn. Var., Earn. Qlty., Inv. Qlty., Leverage, Profitability, Mid Cap, Size, Momentum, Div. Yield, LT Reversal)	
2. Non-target style factors	Constrained at +/-0.25 (Volatility, Growth, Liquidity)	Constrained at +/-0.25 (Beta, Growth, Liquidity, Res. Vol.)	
Active exposure to sector/country factors	± 5%	± 5%	± 5%
Asset weight constraint	Max: Lower of (cap-weight+2% or 10*cap-weight) Min: Higher of (cap-weight-2% or 0)	Max: Lower of (cap-weight+2% or 10*cap-weight) Min: Higher of (cap-weight-2% or 0)	Max: Lower of (cap-weight+2% or 10*cap-weight) Min: Higher of (cap-weight-2% or 0)
Target Risk	Parent Risk	Parent Risk	Parent Risk
Optimization model	GEM2	GEM LT	GEM LT
Rebalancing Frequency, One-way TO/rebalancing	Semi-annual,20%	Semi-annual,20%	Semi-annual,20%



*Value (GEM LT) = (20%*BtoP + 80%*EarnYld), Sector relative, (Earnings Yield represents 4 value descriptors)

**Quality (GEM LT) = (20%*EarnQlty + 20%*InvsQlty + 20%* Profit - 20%*EarnVar - 20%*Leverage), Sector relative

KEY METRICS

Key Metrics

	MSCI World Index	MSCI World Dmf Gem2l Index	MSCI World Dmf Gemlt Evsng Index	MSCI World Dmf Gemlt ALL Index
Total Return* (%)	4.5	8.5	8.2	9.5
Total Risk (%)	15.5	15.9	16.1	15.6
Return/Risk	0.29	0.54	0.51	0.61
Sharpe Ratio	0.15	0.40	0.38	0.47
Active Return (%)	0.0	4.0	3.7	5.0
Tracking Error (%)	0.0	4.1	3.7	4.2
Information Ratio	NaN	0.99	1.00	1.18
Historical Beta	1.00	0.99	1.01	0.97
Turnover** (%)	3.0	40.0	40.0	40.0
Price To Book***	2.2	1.9	1.9	1.9
Price to Earnings***	18.4	13.6	13.7	14.0
Ret on Equity (%)	12.3	14.0	14.1	13.6
Dividend Yield*** (%)	2.3	2.4	2.4	2.3
Number of Stocks***	1623	435	435	410
Days toTrade 95% [†]	0.3	6.1	6.3	6.1

Period: 31-May-1999 to 31-Oct-2016

* Gross returns annualized in USD

** Annualized one-way index turnover over index reviews

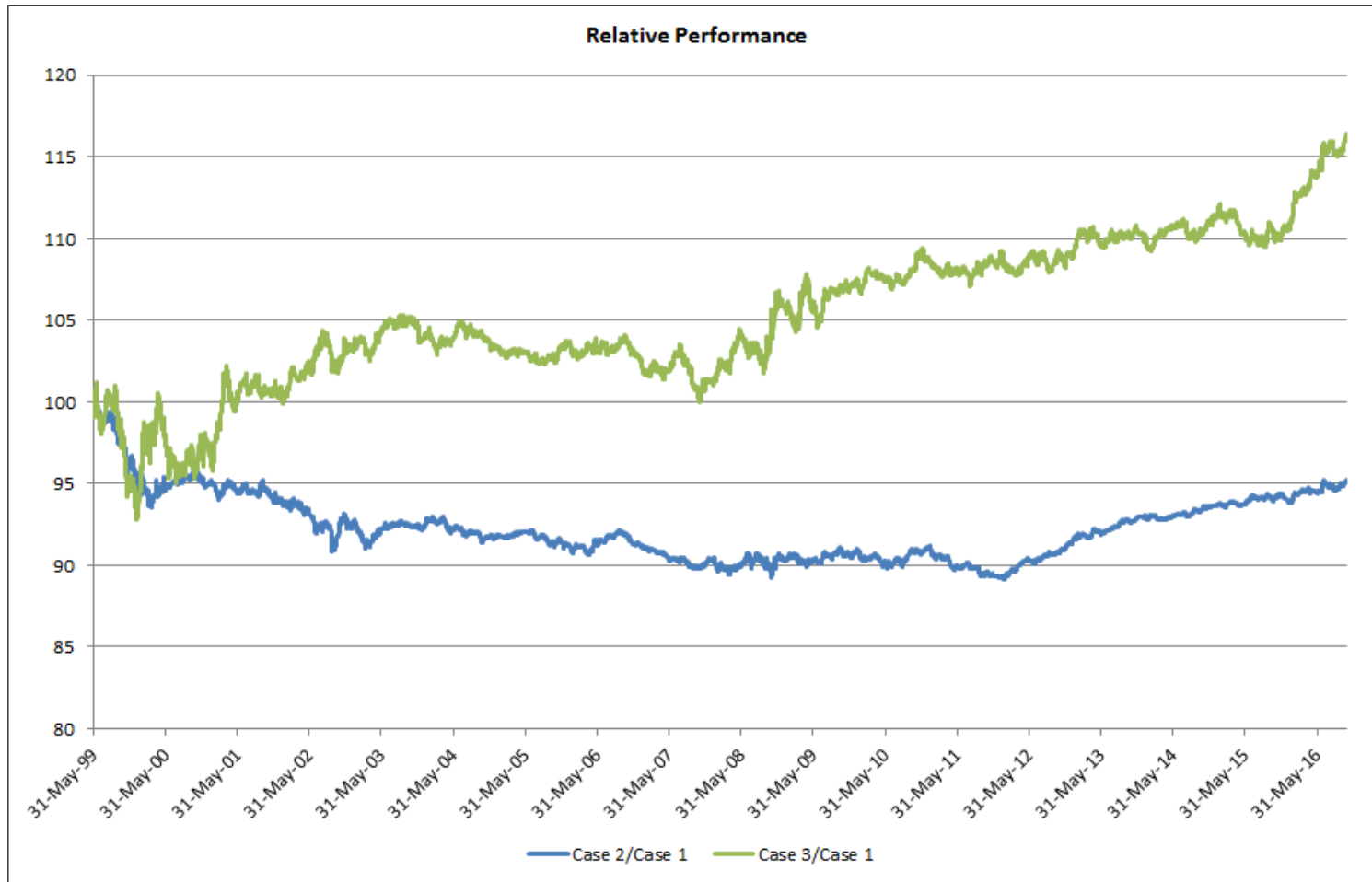
*** Monthly averages

[†]Average of last four index reviews ending 31-Oct-2016 assuming fund size of USD 10.0 bn & daily trade limit of 20%

Active Exp.	World Dmf Gem2l	World Dmf Gemlt Evsng	World Dmf Gemlt ALL
BtoP	0.16	0.15	0.20
Earn. Yield	0.28	0.28	0.36
Size	-0.76	-0.74	-0.70
Mid Cap	0.57	0.55	0.52
Momentum	0.24	0.25	0.24
LT Reversal	-0.14	-0.12	-0.07
Beta	-0.06	-0.05	-0.09
Res. Vol.	-0.24	-0.20	-0.20
Leverage	-0.18	-0.18	-0.26
Earn. Qlty	0.00	-0.01	0.15
Inv. Qlty	0.16	0.15	0.38
Profitability	0.14	0.15	0.31
Earn. Var.	0.03	0.04	-0.08
Div. Yield	0.00	-0.01	0.01
Growth	-0.06	-0.05	-0.10
Liquidity	0.17	0.17	0.18

- Transitioning to “GEM LT ALL” case resulted in improved Sharpe ratio and IR
- Using GEM LT model helped in achieving more prominent active exposures on the target factors

RELATIVE PERFORMANCE OF TRANSITION CASES

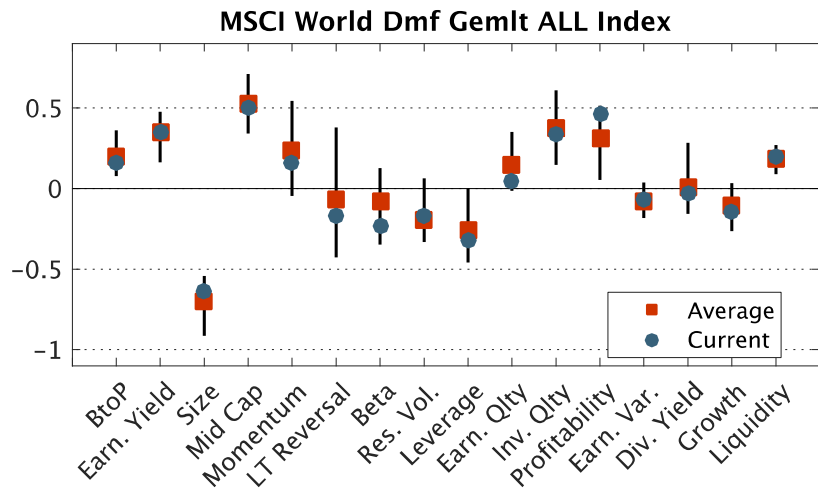
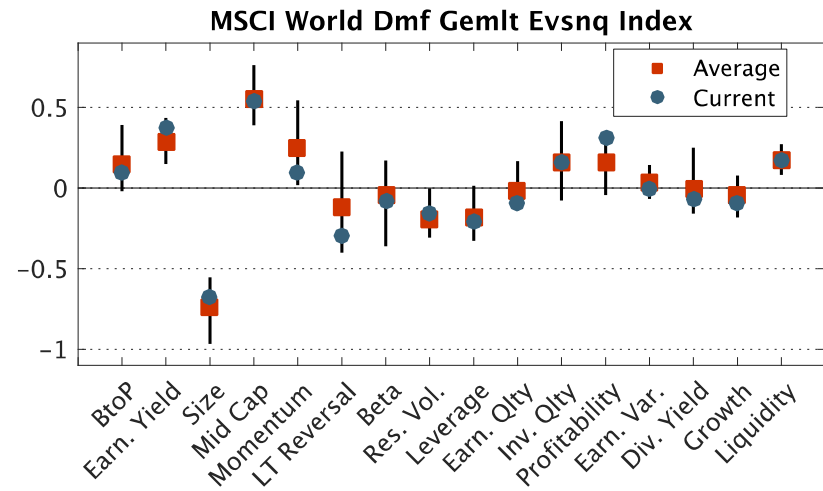
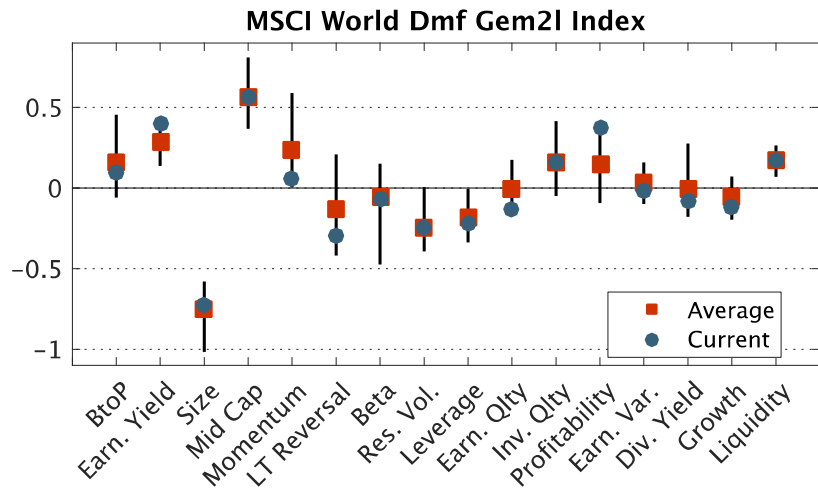


Monthly returns		
	Case 2	Case 3
TE	1.40%	2.57%
Correlation	0.996	0.987

*With reference to Case 1

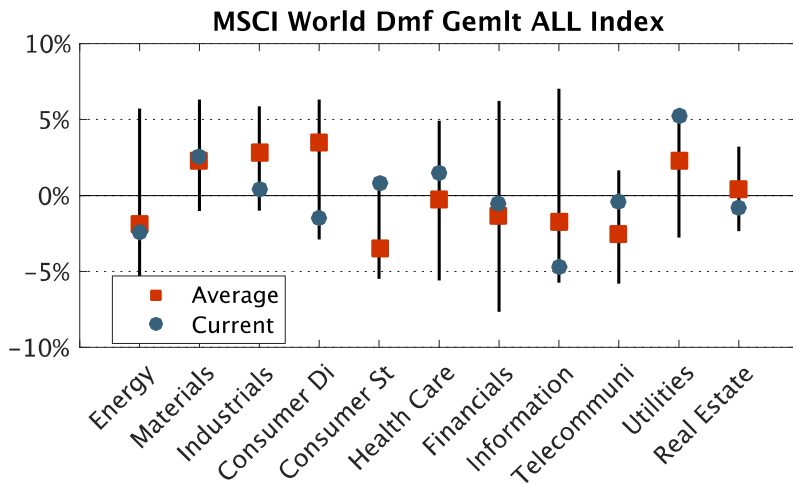
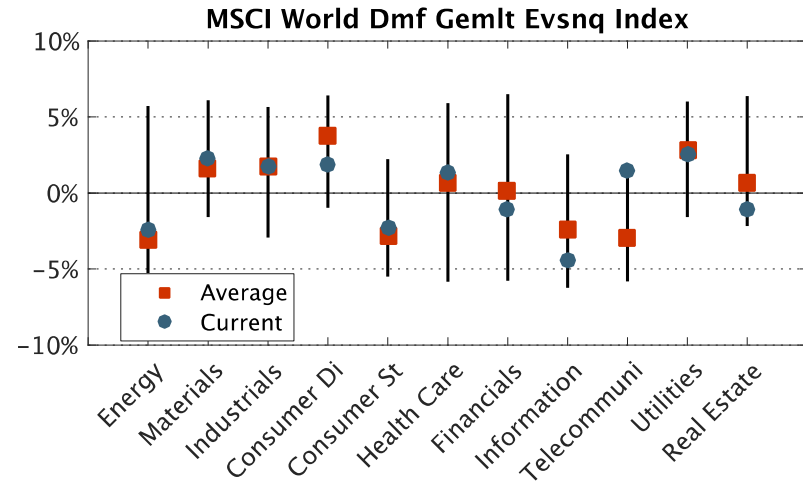
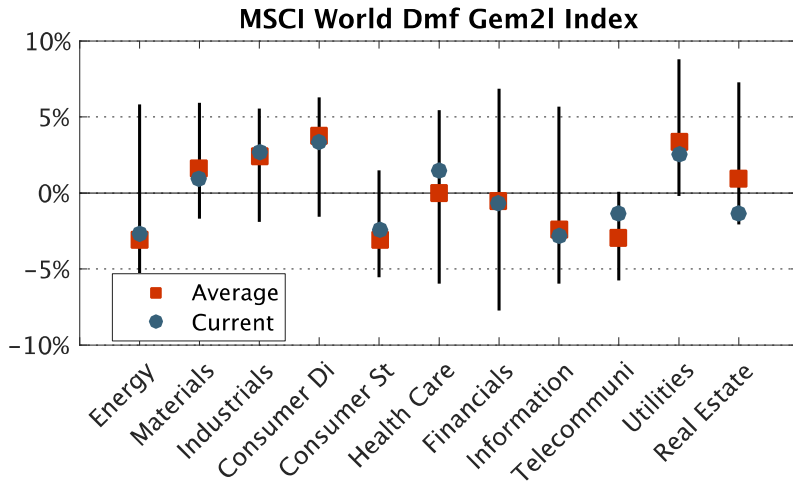
- A strong positive correlation between active returns of GEM LT ALL (case 3) variant with the current GEM2-based index (case 1)

ACTIVE GEM LT FACTOR EXPOSURES



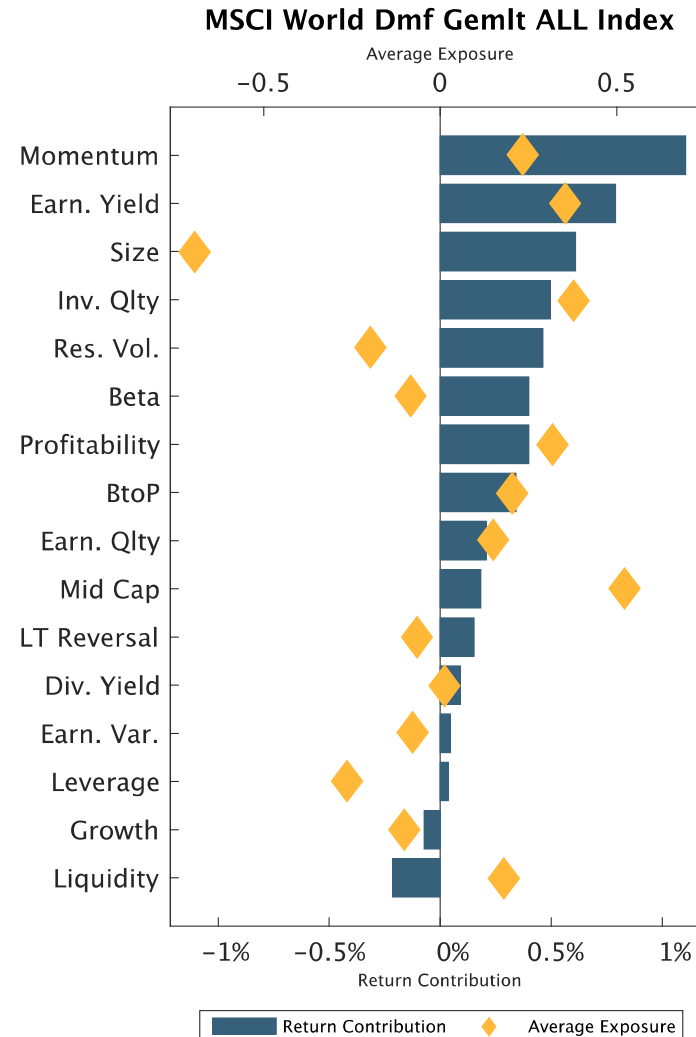
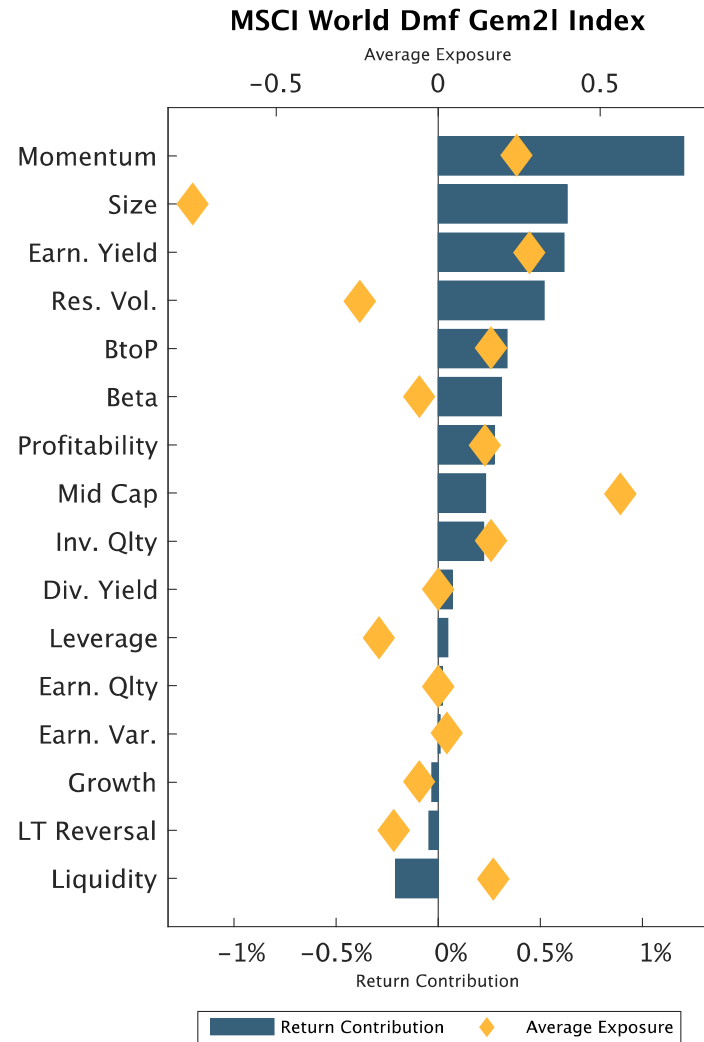
- A more pronounced active exposure to Value and Quality factors in 'GEM LT ALL' case

ACTIVE SECTOR EXPOSURES



- No significant change in sector distribution with change in model or in factor definitions

GEM LT PERFORMANCE ATTRIBUTION



- Improved contribution from Quality factor along with other target factors in 'GEM LT ALL' case

TRANSITION EXAMPLE (01-JUN-2016)

- Transition example analyzed using **Case 2** (DMF GEM LT EVSNQ) and **Case 3** (DMF GEM LT ALL)
- Following turnover scenario variants were analyzed
 - Transition from GEM2 to GEM LT with turnover constraint of 20% (one-way)
 - Transition from GEM2 to GEM LT with turnover constraint of 30% (one-way)
 - Transition from GEM2 to GEM LT without any turnover constraint
- Overview: Number of holdings and realized turnover
 - Realized Turnover

	Existing MSCI World DMF Index		GEMLT_EVSNQ TSTN 20	GEMLT_EVSNQ TSTN NO TOC	GEMLT_ALL TSTN 20	GEMLT_ALL TSTN TO 30	GEMLT_ALL TSTN NO TOC
	pre_rebal (31-May-2016)	post_rebal (01-Jun-2016)					
# constituents	379	381	382	369	367	361	321
Turnover	NA	20%	20%	41%	20%	30%	55%

- **For the ‘GEM LT ALL’ (case 3) setup, we would propose a 10% extra turnover allowance at transition to allow proper adoption of the new factors in the ‘alpha signal’ at the stock level and reduce accumulated path-dependency**
- **We propose no change to the ongoing turnover for the index**

TRANSITION EXAMPLE (01-JUN-2016) (CONTD..)

- Realized Active Factor Exposure and DMF Target Score (analyzed with GEM LT)

	Existing MSCI World DMF Index		GEMLT_EVSNQ TSTN 20	GEMLT_EVSNQ TSTN NO TOC	GEMLT_ALL TSTN 20	GEMLT_ALL TSTN TO 30	GEMLT_ALL TSTN NO TOC
	pre_rebal (31-May-2016)	post_rebal (01-Jun-2016)					
DIVYILD	-0.10	-0.11	-0.08	-0.10	-0.08	-0.09	-0.04
BTOP	0.12	0.04	0.10	0.04	0.19	0.19	0.18
EARNYILD	0.37	0.33	0.34	0.23	0.41	0.39	0.36
EARNQLTY	-0.13	-0.11	-0.06	-0.06	0.04	0.08	0.12
EARNVAR	0.01	-0.03	-0.03	-0.08	-0.04	-0.06	-0.08
INVSQTY	0.15	0.13	0.15	0.15	0.26	0.26	0.31
PROFIT	0.27	0.33	0.30	0.30	0.38	0.41	0.52
LEVERAGE	-0.21	-0.20	-0.21	-0.17	-0.24	-0.27	-0.32
MOMENTUM	0.08	0.22	0.26	0.38	0.19	0.26	0.32
LTREVRSL	-0.29	-0.22	-0.20	-0.08	-0.13	-0.06	0.00
MIDCAP	0.55	0.58	0.56	0.59	0.56	0.57	0.52
SIZE	-0.74	-0.77	-0.74	-0.78	-0.75	-0.76	-0.69
GROWTH	-0.07	-0.05	-0.04	-0.03	-0.12	-0.13	-0.15
RESVOL	-0.30	-0.31	-0.25	-0.25	-0.25	-0.25	-0.25
BETA	-0.10	-0.10	-0.12	-0.22	-0.21	-0.25	-0.25
LIQUIDTY	0.29	0.27	0.25	0.25	0.25	0.25	0.25
Target score	0.31	0.34	0.35	0.37	0.37	0.40	0.40

- Sample transition to 'GEM LT ALL' case with 30% (one-way) turnover constraint resulted in a portfolio with enhanced active exposures to target factors and an almost identical target factor score as the simulation with unconstrained turnover

DMF INDEX TRANSITION PROPOSAL: SUMMARY

- Our analysis indicates that GEM LT enhanced the DMF index construction process
 - GEM LT model has helped track target factors more efficiently
 - GEM LT brought better alignment with the factor definitions
- Should we use GEM LT model to define the target factors as well as the new optimization risk model?
 - This is our proposal for the full transition ('GEM LT ALL')
- Should we constrain the indicated GEM LT factors?
- Should there be the proposed additional 10% turnover for a more complete transition to the newly defined factor signal at the stock level?
- Should ongoing turnover remain at 20% at each SAIR as suggested?

MSCI LOW CARBON INDEXES

LOW CARBON INDEXES: TRANSITION PROPOSAL

- The methodology currently uses GEM3 equity model for optimization
 - Low Carbon Target uses a target forecast Tracking Error optimization
 - Low Carbon Leaders uses a minimize Tracking Error optimization
- Model Style Factors:
 - No specific usage of style factor constraints in the current index methodology
- Model data is used only for security-level risk characteristics
- Proposal:
 - Current Index methodology can be applied as-is with the only change being the switch of optimization model to GEM LT
 - No changes proposed to ongoing turnover
 - No requirement for incremental transition turnover

KEY METRICS

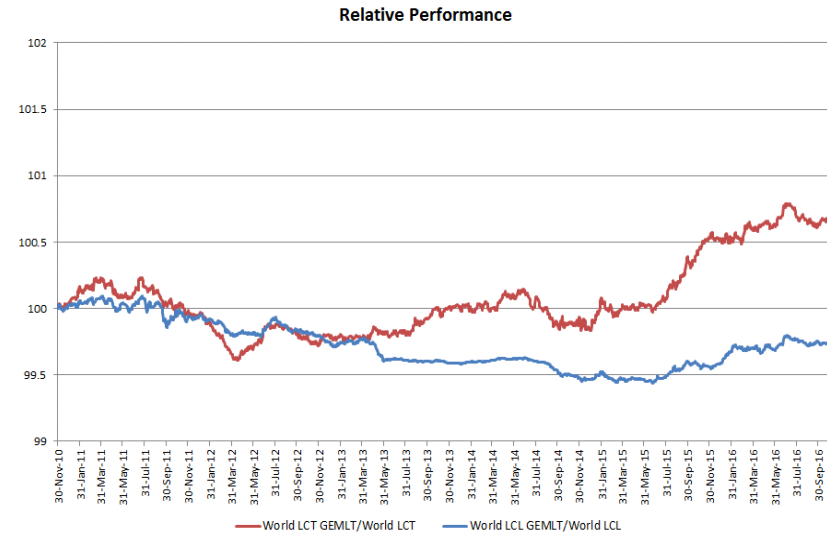
Key Metrics	MSCI World Index	MSCI World LCT Index	MSCI World LCT Gemlt Index	MSCI World LCL Index	MSCI World LCL Gemlt Index
Total Return* (%)	8.9	9.2	9.3	9.4	9.4
Total Risk (%)	12.8	12.8	12.8	12.9	12.9
Return/Risk	0.70	0.72	0.73	0.73	0.73
Sharpe Ratio	0.68	0.70	0.71	0.71	0.71
Active Return (%)	0.0	0.3	0.4	0.5	0.5
Tracking Error (%)	0.0	0.4	0.4	0.5	0.5
Information Ratio	NaN	0.69	1.07	0.99	1.01
Historical Beta	1.00	1.00	1.00	1.01	1.01
Turnover** (%)	1.8	11.2	12.2	12.1	12.1
Price To Book***	2.0	2.0	2.0	2.0	2.0
Price to Earnings***	16.6	16.5	16.5	16.3	16.3
Dividend Yield*** (%)	2.6	2.6	2.6	2.6	2.6
No of Stocks***	1628	1269	1262	1315	1316
Drop in Emission Intensity(%)	-	73.0	74.0	50.0	50.0
Drop in Reserve Intensity(%)	-	87.0	84.0	58.0	57.0

Period: 30-Nov-2010 to 31-Oct-2016

* Gross returns annualized in USD

** Annualized one-way index turnover over index reviews

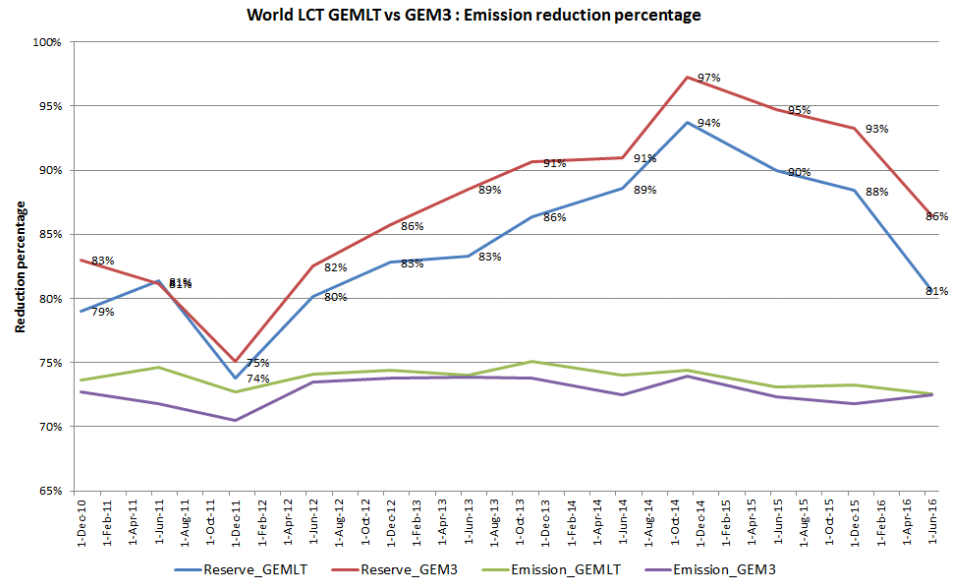
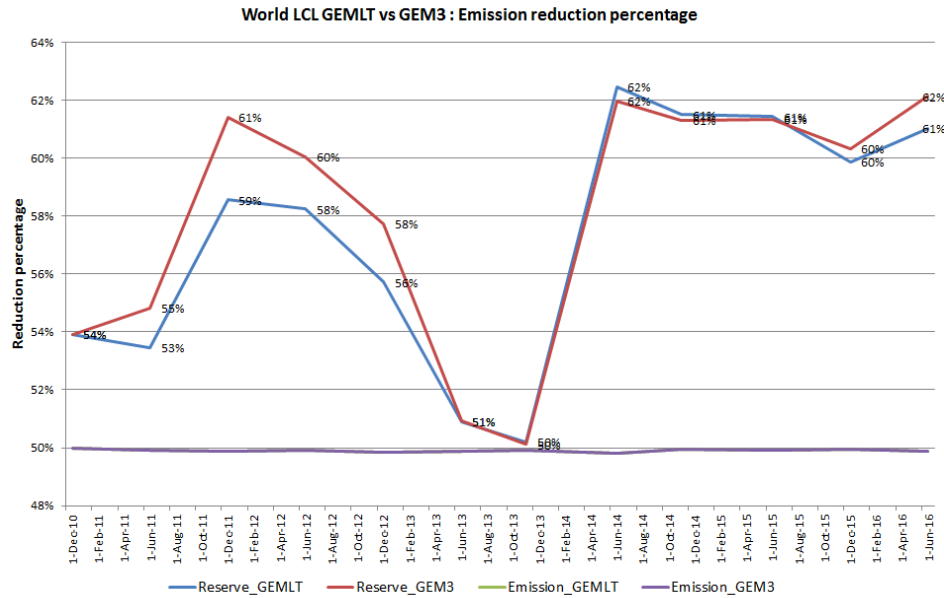
*** Monthly averages



	World LCT GEMLT vs World LCT	World LCL GEMLT vs World LCL
TE	0.25%	0.16%
Correlation	1.00	1.00

- Transitioning to GEM LT model resulted in marginally improved IR and similar Sharpe ratio
- Using GEM LT model did not alter active factor exposures of the Low Carbon indexes
- No significant impact on carbon reduction achieved when the index is moved to GEM LT

CARBON REDUCTION IN LOW CARBON INDEXES



- Model change does not have any significant impact on carbon reduction
- Emissions reduction for given forecast TE is slightly greater in LCT with GEM LT
- Reserves reduction is slightly lower for given forecast TE with GEM LT
- Reserves are focused in few industries; industry risk less prone to under-estimation in GEM LT

Portfolio	Bias Test			Q-stat			Vol (%)
	GEM LT	GEM2L	GEM3L	GEM LT	GEM3L	GEM3L	
GEM LT Industry Active	1.02	1.15	1.14	2.359	2.464	2.437	14.77
GEM2 Industry Active	1.03	1.12		2.354	2.431		14.21
GEM3 Industry Active	1.03		1.11	2.367		2.401	14.21



Forecast tests from *GEM LT Empirical Notes*; colour-coded to indicate reduced under-estimation

MSCI ESG FOCUS INDEXES

ESG FOCUS INDEXES: TRANSITION PROPOSAL

- The methodology currently uses GEM2 equity model for optimization
 - ESG Focus uses a target forecast Tracking Error optimization
- Model Style Factors:
 - No specific usage of style factor constraints in the current index methodology
- Model data is used only for security-level risk characteristics
- **Proposal:**
 - Current Index methodology can be applied as-is with the only change being the switch of optimization model to GEM LT
 - No changes proposed to ongoing turnover
 - No requirement for incremental transition turnover
 - Introduction of post-optimization trim of positions below, for example, the minimum weight in the Parent Index with proportional redistribution (cf. the Low Carbon Target index methodology) instead of using paring constraint*

KEY METRICS – LITTLE IMPACT FROM SWITCH

Key Metrics

	MSCI World Index	World ESG Focus GEMLT	World ESG Focus GEM2
Total Return* (%)	10.1	10.1	10.1
Total Risk (%)	13.4	13.5	13.5
Return/Risk	0.75	0.75	0.75
Sharpe Ratio	0.73	0.74	0.73
Active Return (%)	0.0	0.1	0.1
Tracking Error (%)	0.0	0.6	0.6
Information Ratio	NaN	0.15	0.15
Historical Beta	1.00	1.00	1.00
No of Stocks***	1630	450	471
Turnover** (%)	2.5	33.4	33.4
Price To Book***	1.9	2.0	2.0
Price to Earnings***	16.6	16.5	16.4
Dividend Yield*** (%)	2.6	2.6	2.6

Period: 31-May-2010 to 31-Oct-2016

* Gross returns annualized in USD

** Annualized one-way index turnover over index reviews

*** Monthly averages

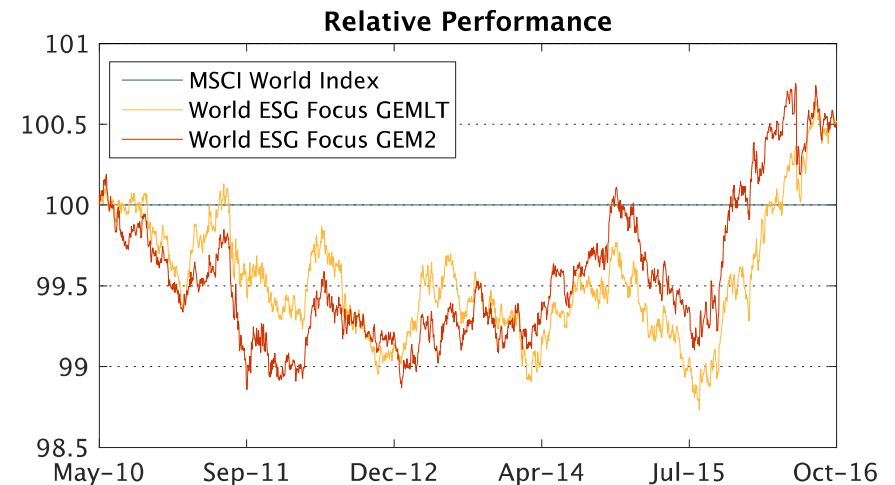
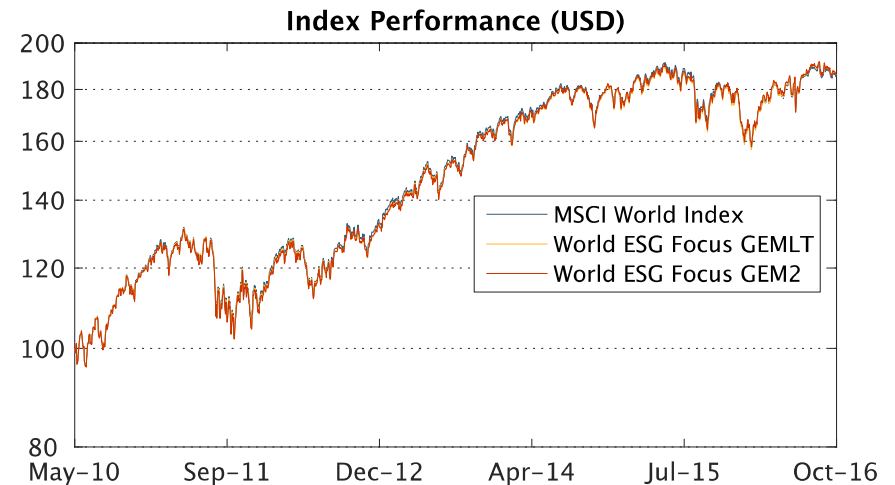
The definitions of all statistical parameters are available in the Appendix

Performance (%)

	MSCI World Index	World ESG Focus GEMLT	World ESG Focus GEM2
YTD	4.0	5.0	4.4
1 Yr	1.8	3.1	2.7
3 Yr	4.4	4.8	4.8
5 Yr	9.6	9.8	9.9
10 Yr	NaN	NaN	NaN

Gross returns in USD for the period ending 31-Oct-2016

Returns are annualized for periods longer than one year



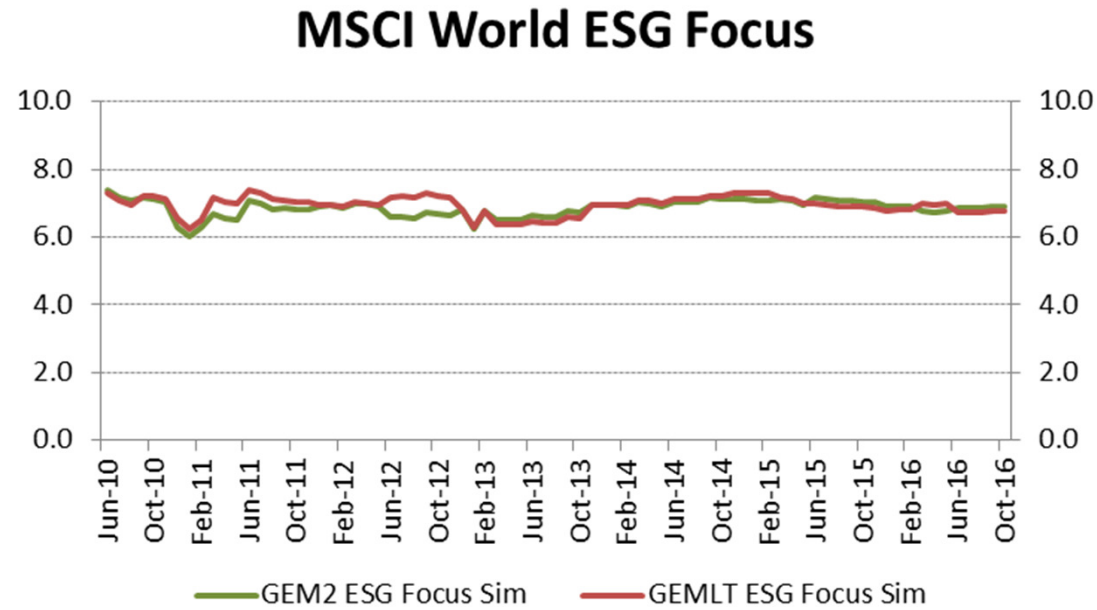
ESG METRICS – LITTLE IMPACT FROM SWITCH

ESG Metrics			
	MSCI World Index	World ESG Focus GEMLT	World ESG Focus GEM2
Integration			
Key Integration Metrics			
ESG Score	5.4	6.8	6.9
ESG Leaders (AAA-AA) (%)	21.4	45.1	47.7
ESG Laggards (B-CCC) (%)	17.1	7.1	6.2
ESG Trend Positive (%)	18.4	16.6	18.8
ESG Trend Negative (%)	10.8	9.4	8.5
ESG Pillars			
Environmental Score	5.5	6.2	6.2
Social Score	4.3	5.0	5.1
Governance Score	4.9	5.2	5.3
Key Governance Metrics			
Lack of Independent Board Majority (%)	12.2	11.9	12.0
Deviation from One Share One Vote (%)	21.6	19.6	20.0
No Female Directors (%)	5.8	4.8	4.6
Values			
Tobacco Producers (%)	1.6	0.0	0.0
Ties to Controversial and Nuclear Weapons (%)	3.2	3.3	3.4
Global Compact Compliance Violation or Watch List (%)	13.1	9.1	8.5
Red Flag Controversies (%)	2.6	0.0	0.0
Orange Flag Controversies (%)	27.5	26.1	24.8

As Of 31-Oct-2016

The definitions of all statistical parameters are available in the Appendix

USE OF GEM LT : LITTLE IMPACT ON INDEX RATING HISTORY



- Index-weighted sum of stock-level MSCI ESG numerical rating scores

MSCI USA ESG SELECT INDEX

MSCI USA ESG SELECT INDEX: TRANSITION PROPOSAL

- The methodology currently uses GEM2 equity model for optimization
 - ESG Select uses a target forecast Tracking Error optimization
- Model Style Factors:
 - No specific usage of style factor constraints in the current index methodology
- Model data is used only for security-level risk characteristics
- **Proposal:**
 - Current Index methodology can be applied as-is with the only change being the switch of optimization model to GEM LT
 - No changes proposed to ongoing turnover
 - No requirement for transition turnover
 - Introduction of post-optimization trim of positions below, for example, the minimum weight in the Parent Index with proportional redistribution (cf. the Low Carbon Target index methodology) instead of using paring constraint*

For a fair comparison (because of a number of methodology changes) , we show ESG Select index simulations with GEM LT and GEM2. The existing index is shown for reference.

KEY METRICS – LITTLE IMPACT FROM GEM LT SWITCH

Key Metrics

	MSCI USA	MSCI USA ESG Select Index	USA ESG Select Sim Gem2	USA ESG Select Sim Gem1tl
Total Return* (%)	12.7	11.6	12.2	12.2
Total Risk (%)	11.8	12.1	11.9	12.1
Return/Risk	1.08	0.96	1.02	1.01
Sharpe Ratio	1.06	0.94	1.00	0.99
Active Return (%)	0.0	-1.2	-0.6	-0.5
Tracking Error (%)	0.0	2.1	1.8	2.0
Information Ratio	NaN	-0.56	-0.31	-0.27
Historical Beta	1.00	1.01	1.00	1.02
No of Stocks***	610	130	154	155
Price To Book***	2.5	2.9	2.8	2.7
Price to Earnings***	17.3	17.7	17.6	17.6
Dividend Yield*** (%)	2.1	2.0	2.1	2.0

Period: 30-Nov-2010 to 31-Oct-2016

* Gross returns annualized in USD

** Annualized one-way index turnover over index reviews

*** Monthly averages

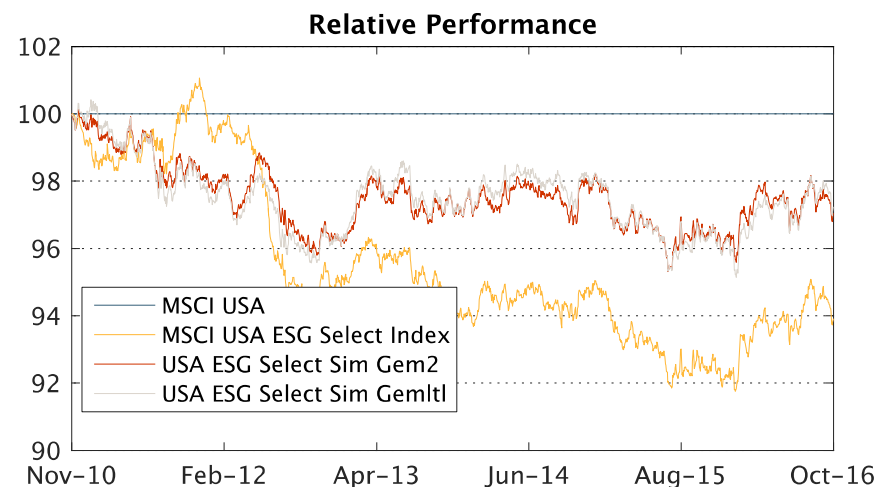
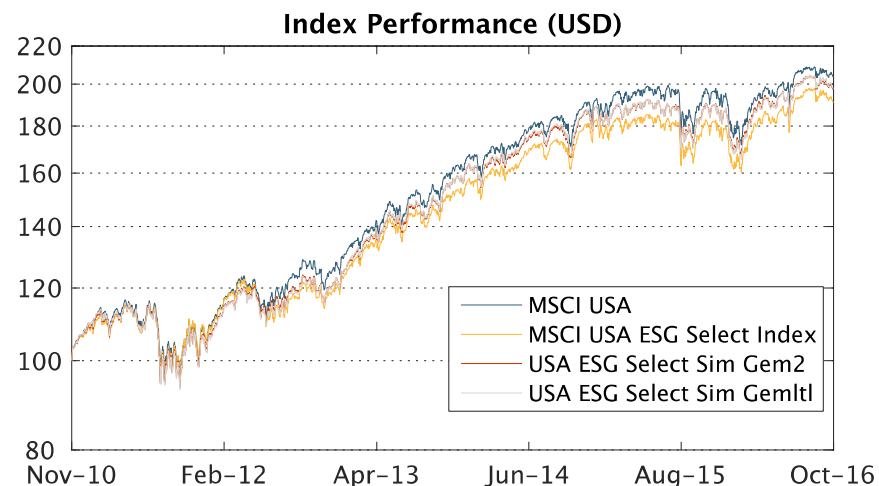
The definitions of all statistical parameters are available in the Appendix

Performance (%)

	MSCI USA	MSCI USA ESG Select Index	USA ESG Select Sim Gem2	USA ESG Select Sim Gem1tl
YTD	5.7	7.7	6.5	6.8
1 Yr	4.3	5.9	5.0	5.3
3 Yr	8.6	8.3	8.5	8.6
5 Yr	13.5	12.0	13.1	13.1
10 Yr	NaN	NaN	NaN	NaN

Gross returns in USD for the period ending 31-Oct-2016

Returns are annualized for periods longer than one year



ESG METRICS – LITTLE IMPACT FROM SWITCH

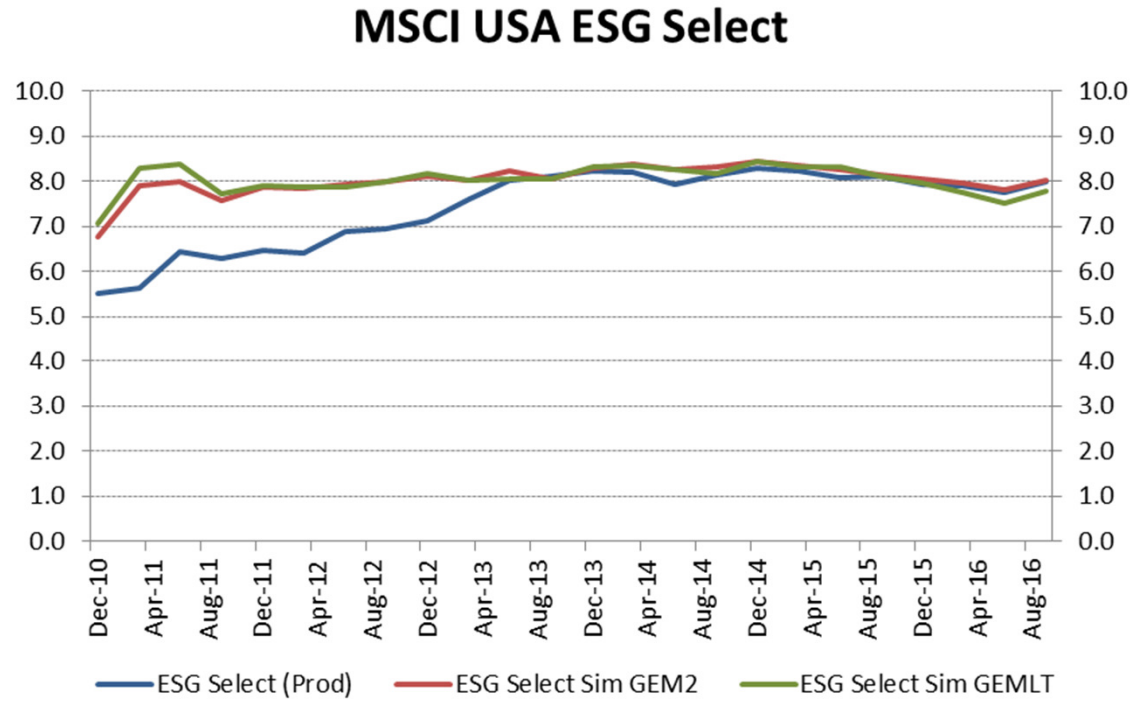
ESG Metrics

	MSCI USA MSCI USA Index	USA ESG ESG Select Index	USA ESG Select Sim Gem2	USA ESG Select Sim GemItr
Integration				
Key Integration Metrics				
ESG Score	4.8	7.9	8.0	7.8
ESG Leaders (AAA-AA) (%)	14.1	67.9	67.2	62.5
ESG Laggards (B-CCC) (%)	24.3	0.2	0.1	0.3
ESG Trend Positive (%)	20.7	19.3	21.3	18.9
ESG Trend Negative (%)	11.4	9.7	9.2	11.3
ESG Pillars				
Environmental Score	5.4	6.8	6.7	6.5
Social Score	4.1	5.7	5.7	5.7
Governance Score	4.7	5.2	5.3	5.2
Key Governance Metrics				
Lack of Independent Board Majority (%)	1.6	0.7	1.3	1.3
Deviation from One Share One Vote (%)	19.4	11.6	9.5	9.3
No Female Directors (%)	1.0	0.0	0.1	0.7
Values				
Tobacco Producers (%)	1.7	0.0	0.0	0.0
Ties to Controversial and Nuclear Weapons (%)	4.7	0.0	0.3	0.0
Global Compact Compliance Violation or Watch List (%)	11.1	5.9	6.2	5.6
Red Flag Controversies (%)	2.3	0.0	0.0	0.0
Orange Flag Controversies (%)	27.4	16.7	15.0	14.6

As Of 31-Oct-2016

The definitions of all statistical parameters are available in the Appendix

USE OF GEM LT : LITTLE IMPACT ON INDEX RATING HISTORY



- Index-weighted sum of stock-level MSCI ESG numerical rating scores

TRANSITION PROPOSALS – SUMMARY

In this material, we have presented detailed analyses for each index methodology

- MSCI Minimum Volatility Indexes
 - Adopt GEM LT as optimization model and modify constrained factors
- MSCI Diversified Multiple-Factor (DMF) Indexes
 - Adopt GEM LT as optimization model and to define target factor exposures
- MSCI Low Carbon Indexes (Target/Leaders)
 - Adopt GEM LT as optimization model
- MSCI ESG Focus Indexes
 - Adopt GEM LT as optimization model and trim small positions
- MSCI USA ESG Select Index
 - Adopt GEM LT as optimization model and trim small positions

We would plan to give six months notice after any public announcement to proceed on any of these recommendations

APPENDIX

MIN VOL - SUMMARY RISK METRICS – OTHER PARENT INDEXES

Key Risk Metrics	World IMI			World Small CAP			USA			ACWI			Ac Asia			EM			Japan			Switzerland IMI		
	Parent Index	MV GEM2	MV GEMLT	Parent Index	MV GEM2	MV GEMLT	Parent Index	MV GEM2	MV GEMLT	Parent Index	MV GEM2	MV GEMLT	Parent Index	MV GEM2	MV GEMLT	Parent Index	MV GEM2	MV GEMLT	Parent Index	MV GEM2	MV GEMLT	Parent Index	MV GEM2	MV GEMLT
Absolute Risk Metrics																								
Total Risk* (%)	15.7	10.4	10.2	18.1	11.1	10.8	15.1	11.2	11.0	16.0	10.5	10.4	16.9	11.9	11.5	22.7	17.6	17.2	16.4	13.2	12.9	16.6	15.7	15.7
Ann. Downside Dev. (%)	11.0	7.1	6.9	12.4	7.4	7.1	10.5	7.6	7.4	11.2	7.1	7.0	11.6	8.0	7.6	15.2	11.6	11.3	11.3	8.8	8.6	11.4	10.5	10.4
Sortino Ratio*	0.51	1.33	1.36	0.72	1.61	1.70	0.44	0.97	1.04	0.39	1.17	1.16	0.38	0.93	1.04	0.50	0.91	0.94	0.18	0.53	0.56	0.72	0.90	0.94
VaR @ 95%	-8.5	-4.7	-4.9	-8.3	-5.0	-5.1	-7.6	-4.8	-4.7	-8.4	-4.9	-5.0	-8.1	-5.4	-4.8	-9.5	-7.5	-7.4	-7.9	-6.1	-5.9	-9.8	-8.8	-8.5
VaR @ 99%	-11.5	-8.6	-8.5	-13.2	-8.4	-8.3	-10.7	-9.4	-8.9	-11.6	-7.9	-8.0	-12.7	-9.4	-9.1	-16.4	-13.0	-13.1	-12.0	-9.5	-9.2	-12.3	-11.7	-11.7
Exp. Shortfall (CVaR) @ 95%	-10.8	-7.2	-7.1	-12.0	-7.5	-7.1	-9.7	-7.4	-7.2	-10.7	-7.1	-7.2	-10.9	-7.9	-7.6	-14.0	-11.1	-10.8	-10.0	-8.5	-8.3	-11.3	-10.4	-10.3
Exp. Shortfall (CVaR) @ 99%	-15.7	-12.0	-11.7	-17.9	-12.1	-11.7	-14.2	-13.0	-12.7	-16.1	-11.6	-11.4	-16.1	-11.4	-10.8	-22.4	-18.2	-17.6	-13.6	-11.1	-11.2	-13.1	-13.0	-12.9
Max Drawdown (%)	57.7	42.9	41.8	61.1	45.5	43.6	54.9	45.0	43.8	58.1	42.8	42.6	56.3	38.9	36.6	65.1	53.6	51.7	53.0	39.6	38.5	52.2	49.3	49.1
Max DD Period (month)	16	16	16	20	21	21	17	17	17	16	16	16	16	16	15	12	12	12	34	24	24	15	15	17
Skewness	-0.73	-1.23	-1.25	-0.69	-1.19	-1.14	-0.50	-0.94	-0.94	-0.62	-0.96	-1.01	-0.44	-0.68	-0.67	-0.42	-0.66	-0.64	-0.15	-0.28	-0.32	-0.60	-0.56	-0.54
Kurtosis	4.82	6.52	6.39	5.10	6.50	6.02	3.89	5.79	5.75	4.47	5.43	5.45	3.93	4.27	4.16	4.13	4.64	4.56	3.26	3.63	3.71	3.54	3.52	3.50
Relative Risk Metrics																								
Tracking Error* (%)	0.0	8.0	8.1	0.0	8.9	9.0	0.0	6.4	6.6	0.0	8.0	8.2	0.0	7.7	8.1	0.0	6.9	7.1	0.0	6.9	7.3	0.0	2.9	2.8
Max DD of Act. Ret. (%)	0.0	20.5	21.7	0.0	25.6	28.4	0.0	16.2	16.4	0.0	18.9	21.6	0.0	20.2	19.1	0.0	16.8	17.6	0.0	19.7	19.0	0.0	6.8	4.6
Max DD of Act. Ret. Period	0	27	27	0	29	29	0	24	24	0	14	27	0	14	16	0	11	11	0	34	32	0	14	11

* Annualized in USD

The definitions of all statistical parameters are available in the Appendix

MV GEM2: Simulation using GEM2 Model (Current Setup)

MV GEM LT: Simulation using proposed approach using GEM LT



MIN VOL - KEY METRICS – OTHER PARENT INDEXES

Key Metrics	World IMI			World Small CAP			USA			ACWI			Ac Asia			EM			Japan			Switzerland IMI		
	Parent Index	MV GEM2	MV GEMLT	Parent Index	MV GEM2	MV GEMLT	Parent Index	MV GEM2	MV GEMLT	Parent Index	MV GEM2	MV GEMLT	Parent Index	MV GEM2	MV GEMLT	Parent Index	MV GEM2	MV GEMLT	Parent Index	MV GEM2	MV GEMLT	Parent Index	MV GEM2	MV GEMLT
Total Return* (%)	5.7	9.4	9.4	8.9	11.9	12.0	4.6	7.4	7.7	4.4	8.3	8.2	4.4	7.5	7.9	7.6	10.6	10.7	2.1	4.7	4.8	8.1	9.5	9.8
Total Risk (%)	15.7	10.4	10.2	18.1	11.1	10.8	15.1	11.2	11.0	16.0	10.5	10.4	16.9	11.9	11.5	22.7	17.6	17.2	16.4	13.2	12.9	16.6	15.7	15.7
Return/Risk	0.36	0.90	0.93	0.49	1.07	1.11	0.31	0.66	0.70	0.28	0.78	0.79	0.26	0.63	0.69	0.33	0.60	0.62	0.13	0.36	0.38	0.49	0.60	0.62
Sharpe Ratio	0.26	0.75	0.77	0.40	0.92	0.96	0.17	0.47	0.51	0.15	0.58	0.58	0.16	0.49	0.55	0.24	0.48	0.50	0.03	0.23	0.25	0.39	0.50	0.52
Active Return (%)	0.0	3.8	3.8	0.0	3.0	3.1	0.0	2.7	3.1	0.0	3.8	3.7	0.0	3.1	3.5	0.0	3.0	3.0	0.0	2.6	2.8	0.0	1.3	1.6
Tracking Error (%)	0.0	8.0	8.1	0.0	8.9	9.0	0.0	6.4	6.6	0.0	8.0	8.2	0.0	7.7	8.1	0.0	6.9	7.1	0.0	6.9	7.3	0.0	2.9	2.8
Information Ratio	NaN	0.47	0.47	NaN	0.33	0.35	NaN	0.43	0.46	NaN	0.48	0.45	NaN	0.40	0.44	NaN	0.43	0.43	NaN	0.38	0.38	NaN	0.46	0.60
Historical Beta	1.00	0.59	0.58	1.00	0.57	0.55	1.00	0.69	0.67	1.00	0.59	0.58	1.00	0.65	0.62	1.00	0.75	0.74	1.00	0.73	0.71	1.00	0.93	0.93
Turnover** (%)	2.8	20.6	20.6	20.2	22.6	23.6	3.0	20.4	20.5	3.4	20.7	20.7	4.9	20.8	20.7	8.2	21.6	21.6	3.3	20.5	20.5	2.1	21.0	19.8
Price To Book***	2.0	2.3	2.4	1.7	1.8	1.8	2.7	3.0	3.0	2.2	2.4	2.5	1.5	1.7	1.7	1.8	2.0	2.0	1.3	1.5	1.5	2.4	2.6	2.6
Price to Earnings***	18.3	18.6	18.2	28.5	19.1	19.0	19.3	19.1	18.6	17.9	18.5	18.3	18.9	18.2	18.8	13.9	14.9	15.4	15.7	18.1	18.3	18.5	17.4	17.3
Dividend Yield*** (%)	2.3	2.8	2.7	1.8	2.9	2.3	1.9	2.4	2.3	2.3	2.8	2.7	1.9	2.5	2.4	2.5	3.2	3.1	1.9	2.0	2.0	2.6	2.6	2.7
Concentration Metrics																								
Avg No of Stocks	6172	416	437	3263	580	596	535	164	164	2414	420	439	896	281	263	791	253	261	336	172	146	109	33	34
Effective No of Stocks	457	221	222	1673	277	278	125	104	103	376	199	197	195	147	132	148	143	147	94	108	95	10	16	17

Period: 31-May-2001 to 30-Jun-2016

*Gross returns annualized in USD

MIN VOL - IMPACT OF CONSTRAINING VALUE FACTOR

Key Metrics

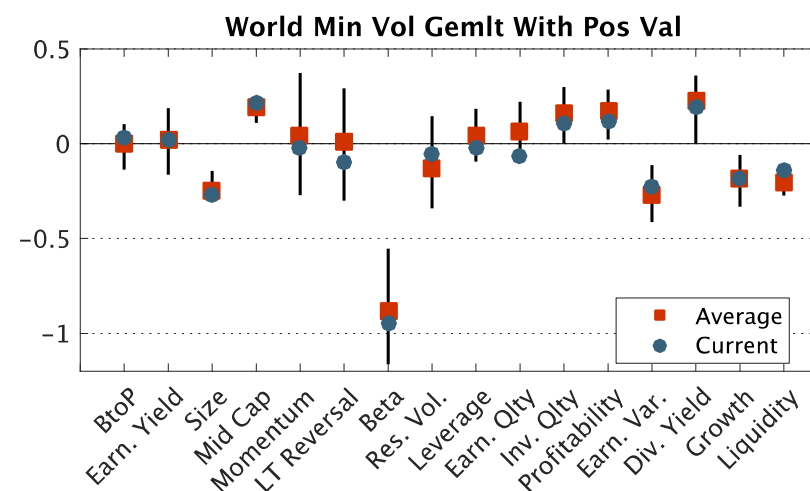
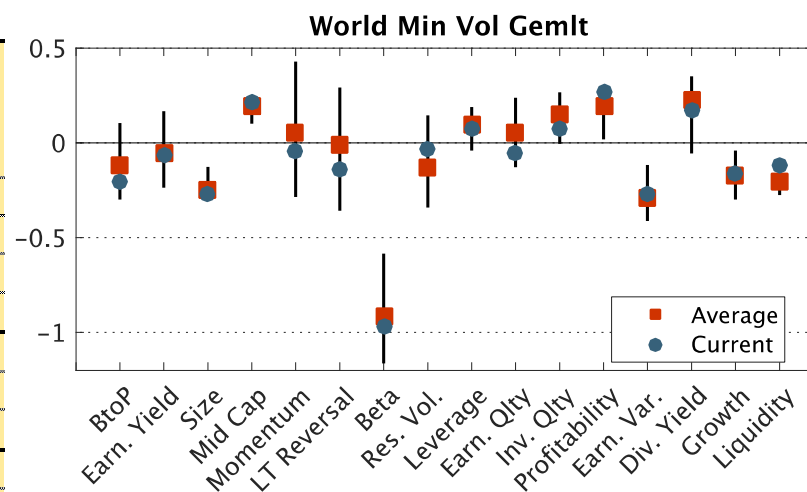
	MSCI World Index	World Min Vol Gemlt	World Min Vol Gemlt With Pos Val
Total Return* (%)	4.5	7.6	8.0
Total Risk (%)	15.5	10.3	10.5
Return/Risk	0.29	0.74	0.76
Sharpe Ratio	0.15	0.54	0.56
Active Return (%)	0.0	3.2	3.5
Tracking Error (%)	0.0	8.0	7.8
Information Ratio	NaN	0.39	0.45
Historical Beta	1.00	0.59	0.61
No of Stocks***	1623	326	335
Large (%)	82.9	73.5	73.3
Mid (%)	17.1	26.5	26.7
Turnover** (%)	3.0	20.1	20.1
Price To Book***	2.2	2.5	2.2
Price to Earnings***	18.4	18.6	17.5
Dividend Yield*** (%)	2.3	2.6	2.6
Max Drawdown (%)	57.5	42.5	42.7
Max Drawdown Period (in months)	16	16	16
Max Drawdown of Active Returns (%)	0.0	20.9	16.8
Max Drawdown of Act. Ret. Period	0	27	24

Period: 31-May-1999 to 31-Oct-2016

*Gross returns annualized in USD

** Annualized one-way index turnover over index reviews

*** Monthly averages



MIN VOL - IMPACT OF ACTIVE CURRENCY CONSTRAINTS

Key Metrics

	MSCI World Index	World Min Vol Gemlt	World Min Vol Gemlt Curr Const 5pct.
Total Return* (%)	4.5	7.6	7.5
Total Risk (%)	15.5	10.3	10.4
Return/Risk	0.29	0.74	0.73
Sharpe Ratio	0.15	0.54	0.52
Active Return (%)	0.0	3.2	3.1
Tracking Error (%)	0.0	8.0	8.0
Information Ratio	NaN	0.39	0.38
Historical Beta	1.00	0.59	0.59
No of Stocks***	1623	326	326
Turnover** (%)	3.0	20.1	20.1
Price To Book***	2.2	2.5	2.5
Price to Earnings***	18.4	18.6	18.5
Dividend Yield*** (%)	2.3	2.6	2.6

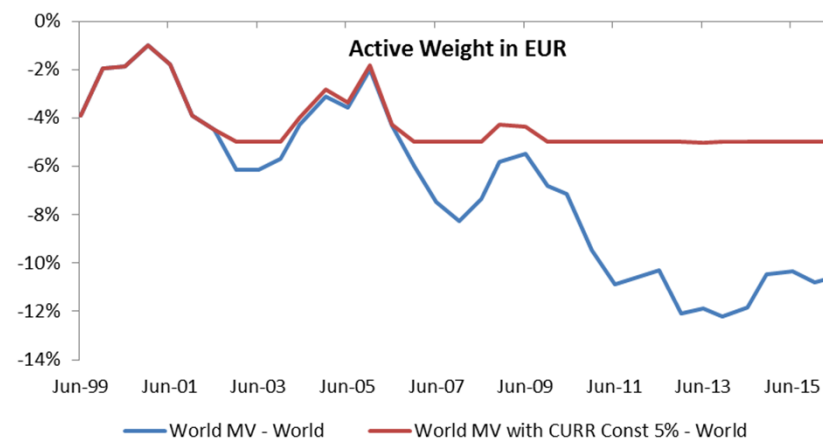
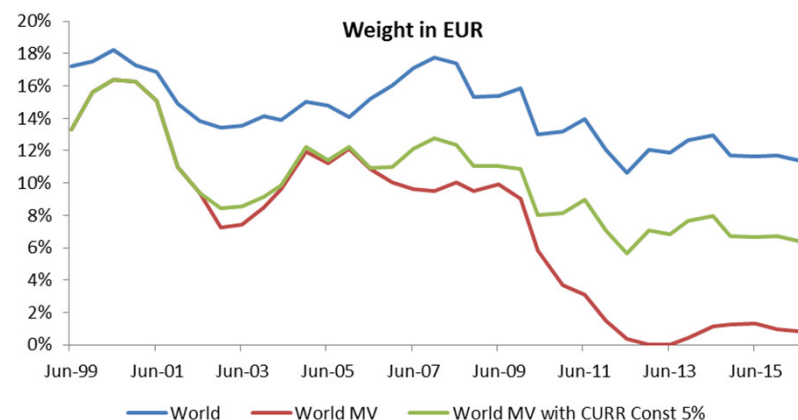
Period: 31-May-1999 to 31-Oct-2016

* Gross returns annualized in USD

** Annualized one-way index turnover over index reviews

*** Monthly averages

The definitions of all statistical parameters are available in the Appendix



MIN VOL - KEY RISK METRICS: THE EFFECT OF TURNOVER

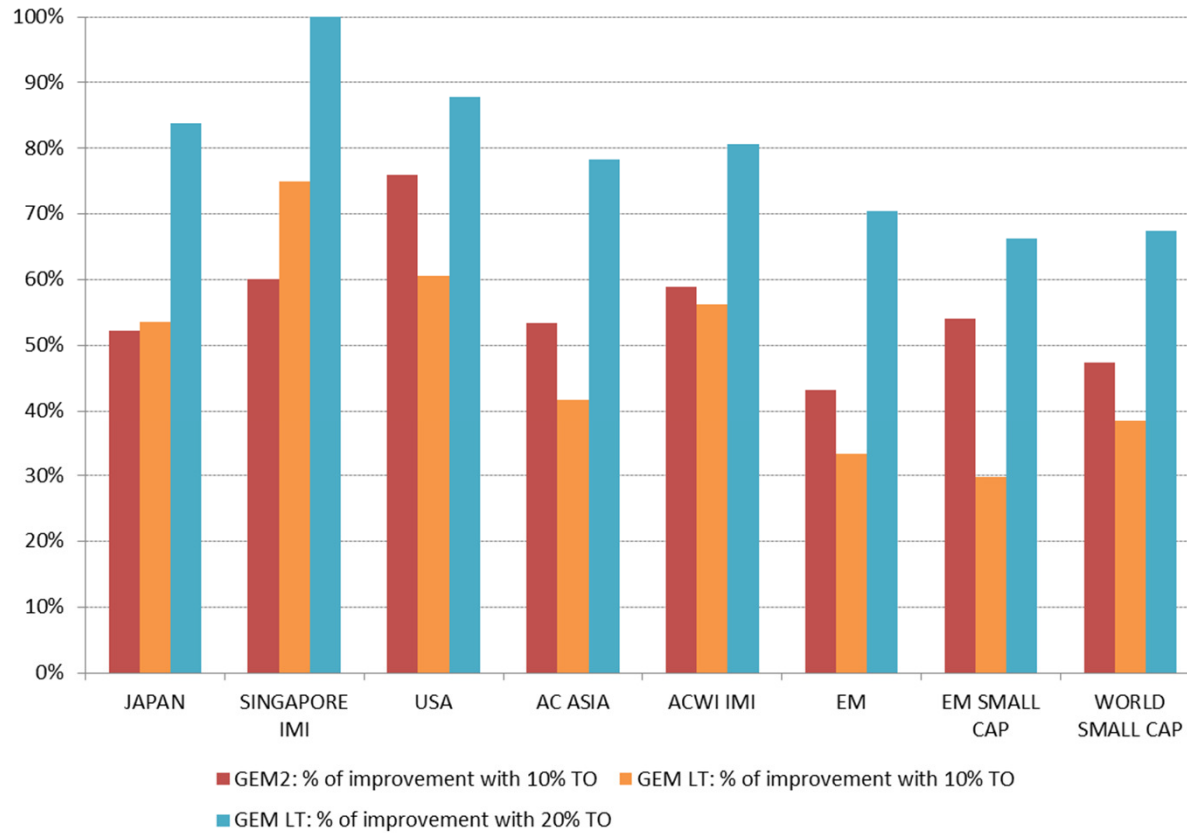
Key Metrics

	MSCI World Index	World Min Vol Gem2l	World Min Vol Gem2l W/o TO	World Min Vol Geml V1	World Min Vol Geml V1 W/o TO
Absolute Risk Metrics					
Total Risk* (%)	15.5	10.5	10.1	10.3	10.0
Annualized Downside Deviation* (%)	10.9	7.1	6.9	7.0	6.8
Sortino Ratio*	0.41	1.08	1.07	1.08	1.12
VaR @ 95%	-8.4	-4.9	-5.0	-5.1	-5.1
VaR @ 99%	-11.3	-8.1	-7.6	-8.3	-7.8
Expected Shortfall (CVaR) @ 95%	-10.5	-7.2	-7.0	-7.2	-6.9
Expected Shortfall (CVaR) @ 99%	-15.4	-11.9	-11.3	-11.8	-11.5
Max Drawdown (%)	57.5	43.1	41.5	42.5	39.6
Max Drawdown Period (in months)	16	16	16	16	16
Skewness	-0.62	-0.97	-1.02	-1.02	-1.07
Kurtosis	4.38	5.56	5.59	5.56	5.68
Relative Risk Metrics					
Tracking Error* (%)	0.0	7.9	8.2	8.0	8.3
Total Risk (%)	15.5	10.5	10.1	10.3	10.0
Return/Risk	0.3	0.7	0.7	0.7	0.8
Sharpe Ratio	0.2	0.5	0.5	0.5	0.6
Active Return (%)	0.0	3.2	2.9	3.2	3.2
Tracking Error (%)	0.0	7.9	8.2	8.0	8.3
Information Ratio	NaN	0.4	0.4	0.4	0.4
Historical Beta	1.0	0.6	0.6	0.6	0.6
Turnover (%)	3	20	62	20	55

Period: 31-May-1999 to 31-Oct-2016

* Gross returns annualized in USD

PROPOSED TRANSITION – INCREMENTAL TURNOVER ANALYSIS



Simulated reduction in estimated risk from pre-rebalance index toward ‘unconstrained turnover’ optimized index expressed as percentage of forecast risk ‘gap’ (November 2016 SAIR)

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